

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : E01F 13/00, 13/04, B66D 1/60, E05B 53/00	A1	(11) International Publication Number: WO 00/20692 (43) International Publication Date: 13 April 2000 (13.04.00)
---	----	--

(21) International Application Number: PCT/AU99/00846

(22) International Filing Date: 1 October 1999 (01.10.99)

(30) Priority Data:

PP 6306	1 October 1998 (01.10.98)	AU
PQ 1385	2 July 1999 (02.07.99)	AU

(71) Applicant (for all designated States except US): MATILDA PRODUCTS LTD. [AU/AU]; Level 42, 152 St. Georges Terrace, Perth, W.A. 6000 (AU).

(72) Inventors; and

(75) Inventors/Applicants (for US only): THOMPSON, Ian, Reginald [AU/AU]; 25 Juniper Way, Duncraig, W.A. 6023 (AU). SARICH, Ralph, Tony [AU/AU]; Level 42, 152 St. Georges Terrace, Perth, W.A. 6000 (AU).

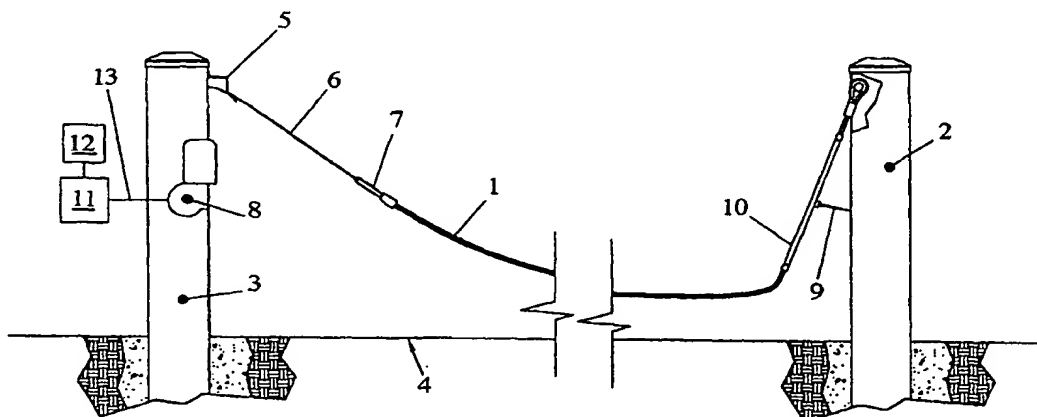
(74) Agent: WATERMARK PATENT & TRADEMARK ATTORNEYS; Durack Centre, 4th floor, 263 Adelaide Terrace, Perth, W.A. 6000 (AU).

(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published

With international search report.

(54) Title: CABLE GATE



(57) Abstract

A gate for controlling passage through an opening including a first support means located on one side of the opening, a second support means located on the other side of the opening, at least one elongate member, having a first and a second end, extendable across the opening between the first and second support means; and a control means for releasing the at least one elongate member to thereby enable passage through the opening, and drawing in the elongate member to thereby restrict passage through the opening.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

CABLE GATE

FIELD OF THE INVENTION

The present invention relates to an improved gate, and in particular to cable or chain security gates, and may for example be used to replace existing boom and security gates.

BACKGROUND OF THE INVENTION

Conventional gates are used either to prevent unauthorised access to a site (security), or for access control purposes.

Security gates prevent vehicular access and are constructed in a variety of formats. Typical examples incorporate sliding, swinging, or vertically raising (or lowering) panels, and are constructed of steel tube, wood, steel mesh, plastic, other materials, or combinations of these materials. The gates may be manually opened, or may utilise one of a number of alternative hydraulic, electrical, electro-hydraulic, or other actuation mechanisms. Automatic control devices may also be provided, to allow for remote (wireless) or security system opening of the gate. As well as preventing unauthorised access, these gates also provide access control.

Another form of access control gate is the boom gate, constructed typically of a long wooden, aluminium or steel beam pivoted about a horizontal axis at one end. Applications include access control into public car parks, and as warning devices at railway level crossings. Boom gates are used more for access control, than security purposes, as it is not very practical to construct them strong enough to prevent deliberate unauthorised access. These gates may also be automatically, manually, or remotely opened and closed.

A number of functional weaknesses may be noted for most conventional gates, particularly automatic gates.

Most automatic gates are quite expensive to purchase and operate, as the gate panels are heavily and expensively constructed, their actuation mechanisms are large and costly, mechanical and electrical or hydraulic services must be installed and connected between the gate and a suitable source, and considerable work is needed to provide the foundations for the necessarily precise gate mechanisms.

Existing gates are also not very space efficient. For example, a swinging

gate must have room for the gate panels to swing into, and the panel of a sliding gate requires at least the full opening width again, behind an associated fence. Similarly, poles that are raised telescopically from a hole in the ground require substantial below-ground excavation, and are prone to jamming due to the ingress of sand and water.

Further, many gates are not constructed strong enough to withstand deliberate attempts at unauthorised access, and most automated gates are relatively slow to open (for safety reasons).

Conventional swinging, sliding, or raising gates also tend to be quite slow to open and close, particularly if they are built heavy and strong to withstand deliberate attempts at unauthorised access. The reasons are twofold. Firstly, the inertia of these types of gates is large, requiring high accelerating forces to achieve reasonable speed of operation. This would require large and expensive actuation mechanisms, making the whole approach commercially unattractive.

The second, and more important reason, is that heavy gates travelling at high speed (and using high forces) would present a serious hazard to personnel, animals, and equipment such as vehicles. This is because, due to the extremely high inertia levels that would be involved, their overload protection and other safety devices would be rendered ineffective. This is particularly the case if the gates are automatic, and therefore may be operated unintentional, or unexpectedly.

Slow opening times can be particularly annoying to the user, who may need to make regular authorised accesses to a secure site. For example, this may include a home owner entering his own property, or someone wishing to legitimately enter a private parking area. Generally, it is usually not so important for the gate to close quickly.

A further problem with existing gates is their operation when their power source is removed, either through a power failure or illegal means. In many cases, the gate is configured to automatically open in the event of a power failure, for example the gate is no longer held closed, as a spring acts to open the gate. Obviously, security is compromised in such situations.

OBJECT OF THE INVENTION

It is an object of the present invention to provide a gate which addresses at

least one of the weaknesses of conventional gates identified above. In particular it is an object of the present invention to provide an improved gate that is low in power consumption, space efficient, fast to open, in-expensive to manufacture and install, intrinsically safe, and ideally automatic and more effective in restricting deliberate attempts at unauthorised vehicular access.

SUMMARY OF THE INVENTION

With the above object in mind the present invention provides in one aspect:

a gate for controlling passage through an opening including:

a first support means located on one side of the opening;

a second support means located on the other side of the opening;

at least one elongate member, having a first and a second end, extendable across the opening between said first and second support means; and

a control means for releasing said at least one elongate member to thereby enable passage through said opening, and drawing in said elongate member to thereby restrict passage through said opening.

In the preferred embodiment the elongate member could be a cable, or alternatively a chain, rope, cord, rod or pipe provided with flexible end fittings, or similar arrangement.

In a further preferred embodiment, the first and second support means could be posts. Alternatively, walls, or many other forms of architectural structures (for example columns, arch supports, beams, light poles, or even statues), could form the support means. For simplicity further reference will only be made to posts, although it will be understood that this reference also refers to all other structures.

Preferably, the control means would be located substantially wholly within one of said first or second support means, to limit access to said control means.

The gate could further include a locking means to prevent unwanted release of the at least one elongate member once the at least one elongate member has been fully drawn in. Conveniently the locking means could include a latching means adapted to engage a thimble assembly attached to the at least one elongate member.

Preferably the gate further includes a first line connecting said first end of

said at least one elongate member to a first winch means such that said first winch means operates to draw in said first line thereby drawing in said at least one elongate member. Ideally, the first line is thin and lightweight, for example it could be a steel or synthetic cable or strap. Further, the first line could be attached to said thimble assembly.

The second support means may further include a first tracking means to draw said at least one elongate member towards said second support means during release of the at least one elongate member. Further, said first support means may also include a tracking means. The first tracking means may include an aperture in said second support means through which a first counterweight line may pass. One end of said counterweight line being attached to said at least one elongate member, and the other end attached to a first counterweight.

Ideally the aperture would be located a predetermined distance below said at least one elongate member and substantially equal to the distance between said second support means and a point where said first counterweight line is attached to said at least one elongate member.

A further improvement to enable tracking of the said at least one elongate member along a side of said second support means would include a bar running along an end portion of said at least one elongate member, and adjacent to said second support member.

Where a plurality of elongate members are provided, it may be preferable to provide a bar, running along an end portion of each, or a selection of, the elongate members, to further improve tracking.

Alternatively, said at least one elongate member is connected to a bar pivotally attached to said second support means.

Alternatively, a resilient means could be utilised in place of said first tracking means.

The control means will preferably include a winch means including:
a winch drum fixed to a drive shaft.

Preferably, however, the control means could include a winch means including:

a winch drum adapted to freely rotate on a drive shaft;
a drive collar rotatable with, and slidable along, said drive shaft;

an engaging means adapted to enable said drive collar to engage and disengage said winch drum.

Ideally, a braking means is provided to limit the speed of the winch drum when not engaged with said drive collar.

5 In a further preferred aspect the present invention provides a second tracking means to track said first line along said winch drum including:

- a fixed pulley;

- a second pulley mounted on an arm, said arm being spring loaded and capable of swinging;

10 wherein said first line tracks around said fixed pulley and then said second pulley prior to being wound on said winch drum.

In another preferred aspect the present invention provides an improved latch mechanism including:

- a latch or locking pin adapted to be released by a release lever;

15 a first and a second spring each fixed at one end;

- a belt passing around a pulley means and connecting said first spring to said second spring; and

- a release line attached to said release lever and said belt.

20 Conveniently, the release line may pass through the centre of the first spring, or alternatively in some arrangements the release line may pass outside of the spring.

In the preferred embodiment of the present invention the latch mechanism would be driven by said winch means. Further, the release lever would also include a return spring adapted to return the release lever to a locked position.

25 In a further aspect the present invention provides a latch mechanism including:

- a latch or locking pin adapted to be released by a release lever;

- a member attached via a ratchet means to a winch means; and

- a release line joining said release lever to said member.

30 In a preferred aspect the present invention provides an improved latch mechanism including:

- an assembly adapted to slide along and rotate with a drive shaft; said assembly including a pulley and clutch dog;

a plurality of cams, including a first and second cam;
a plurality of reaction plates, including a first and second reaction plate;
wherein said first cam is adapted to engage said first reaction plate, to thereby
engage said clutch dog with a winch means; and said second cam is adapted to
5 engage said second reaction plate, to thereby disengage said clutch dog from said
winch means.

In a further aspect the present invention provides a battery located wholly
within said first or second support means to provide the power to operate the
gate. Preferably, an external power source will be connected to the battery to
10 enable the battery to be recharged. In this arrangement one external power
source, by mains or solar, need not have sufficient power to operate the gate, but
rather need only be capable of recharging the battery over time.

In some applications it may be desired to provide a series of gates as
defined by the present invention. In such an arrangement a predefined distance
15 may be left between adjacent gates, or alternatively two adjacent gates may have
a common support means.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be further described with reference to the
accompanying drawings. It will be appreciated by the person skilled in the art that
20 other embodiments of the present invention are possible, and therefore the
particularity of the accompanying drawings is not to be understood as
superseding the generality of the preceding description of the invention.

Figure 1 shows the overall configuration of the improved gate in a partially
closed configuration.

25 Figure 2a shows the locking action of the latch mechanism

Figure 2b shows the locked position of the gate.

Figure 3a shows the spring arrangement during locking.

Figure 3b shows the spring arrangement during the process at unlocking
and cable release.

30 Figures 4a and 4b show the operation of a counterweight in the preferred
embodiment.

Figure 5a shows a cross section of the gate clutch system.

Figure 5b shows the clutch disengaged.

Figure 5c shows the clutch engaged.

Figure 6 shows the winch braking arrangement.

Figure 7a shows a cross section of an alternative clutch system.

Figure 7b shows the clutch disengaged in the alternative arrangement of
5 Figure 7a.

Figure 7c shows the clutch engaged in the alternative arrangement of
Figure 7a.

Figures 8a and 8b show a tracking system and overload sensing
arrangement of the preferred embodiment.

10 Figure 9 shows a lock detecting arrangement of the preferred embodiment.

Figures 10a and 10b show the principal of the V-belt arrangement.

DETAILED DESCRIPTION OF DRAWINGS

Referring now to Figure 1, the present applicants have found it feasible to
construct a security gate using steel cable (1) or chain stretched between two
15 anchor posts (2, 3). By making the cable (1) or chain permanently anchored at a
second post (2), and capable of being fed out from, or drawn into a first post (3), it
is possible to effectively open and close the gate to vehicular traffic. Alternatively,
the cable (1) or chain could also be fed out from, and drawn into the second post
(2) as well as the first post (3), if required. In the open position, the cable (1) or
20 chain would be arranged to lie on the road (4) or ground surface, or in a suitable
groove, for vehicles to drive over. When closed, the cable (1) or chain would form
a barrier between the two posts(2, 3), preventing access.

If high strength steel cable or chain had been previously considered for the
gate of the present invention then conventional teaching of a means for reeling
25 the cable or chain into the post would have resulted in a necessarily large, heavy,
expensive, and bulky apparatus. This is because the winch drum must be of
sufficiently large diameter to accept the heavy cable or chain, and must be
sufficiently strong to support the maximum tension loads if an attempt is made to
breach the gate. For steel cable, the winch drum must also be sufficiently large to
30 prevent the cable from going below a minimum bend radius, thereby
compromising the cable's fatigue life, or from being irreversibly distorted which
will render it unusable in that it would not lie flat on the road.

Therefore, in the present invention, a high strength cable (1), preferably

steel, may be anchored to a passive post (2) located to one side of an opening or roadway (4), and the other end of the main cable (1) can be drawn into a master post (3) located on the other side of the roadway (4), by means of a thin light-weight "pull-in" cable (6). This second end of the main cable is fitted with a
5 thimble assembly (7) (or similar), which can be locked into place in the master post (3) by a latching mechanism once the gate is fully closed. Figure 2a shows the thimble (7) being drawn over the latch (20), by the action of the winch (25) and pull-in cable (6) preparatory to the gate locking. It can be seen that as the thimble (7) is drawn past the latch (20) the latch return spring (23) is stretched.
10 Once the thimble (7) has passed the latch (20) the return spring (23) causes the lever arm (22) to return the latch (20) to its locked position thereby locking the gate, as can be seen in Figure 2b.

In the preferred embodiment a 10 mm diameter stainless steel wire rope forms the main cable (1), as this provides a suitably high level of strength, is
15 corrosion resistant, is relatively difficult to cut, and does not cause undue damage to the road (4), or impede the passage of normal vehicles over it. Depending on the application and strength requirements of the cable, larger or smaller diameter cable can be selected, or even synthetic cord or rope can be utilised.

It has been found that an 8 tonne force would be required to pull out a 10
20 mm steel cable from the master post (3) of the present invention. Accordingly, the selection of the post material and/or modifications of the post (2, 3) may be necessary dependent on the cable (1) selected for the particular application, so as to ensure the gate works effectively, and that the post (2, 3) is not unduly weak.

25 The pull-in cable (6) strength, and therefore diameter, should be selected to suit the main cable span, and diameter or weight of the main cable (1). Tests have shown a 1.6 mm diameter cable to be suitable for use with a 10 mm diameter main cable over realistic spans, providing both satisfactory performance and fatigue life. Ideally, the pull-in cable (6) is also a stainless steel wire rope for
30 its corrosion resistance, and should be of a flexible weave to enable the cable (6) to lay neatly on the winch drum (25) and pass easily over the pulleys.

Once it is in place and locked, then the main cable (1) is unable to be withdrawn from the master post (3) even at high force levels, unless the latch (20)

is first unlocked. This is ideally performed by an internal mechanism, that is, a mechanism that is not readily accessible from the outside of the gate. The latching function may take the form of a latch (20) attached to a latch pivot shaft (21). This form of latch is, in a sense, self-energising, in that any attempt to withdraw the main cable (1) only acts to more strongly hold the latch (20) closed. It is necessary for the latch (20) to be rotated against the cable load, in order for the cable thimble (7) to be released. A lever arm (22) attached to the latch pivot shaft (21) may be utilised to perform this unlocking function. Alternatively, a retracting bolt or other form of latch could be utilised.

The internal mechanism required to release the latch might take the form of an electrical solenoid, which could for example pull back a bolt, an electric motor drive, a manually operated key assembly, or other similar means.

The present invention could be operated by a simple control system (11) used to control operation of the electric motor (8), and of the unlocking mechanism. Additionally, micro-switches may be used to detect both the locked and unlocked status of the gate.

The pull-in cable (6) is not exposed to the security loads needed to be withstood by the main cable (1), and therefore need only be strong enough to draw, or pull-in, the main cable (1) to the master post (3) latch mechanism (20), and may therefore be constructed using quite small diameter wire rope, or even synthetic material such as a nylon rope. The pull-in cable winch drum (25) may similarly be constructed to be physically small, of low cost, and light-weight. In the preferred embodiment, the winch drum (25) and winch shaft (26) are made of inexpensive plastic materials, and are small enough to be fitted within the master post (3). Similarly, the winch drive mechanism may also be constructed using small, light-weight, and inexpensive componentry. In the preferred embodiment, this drive mechanism makes use of a very low-cost electric motor and drive assembly, such as normally might be used for high volume automotive application, for example driving windscreen wipers or window winders. In preferred embodiments it may be feasible to mount a smaller drive motor inside the existing post, or to fit the prototype motor within a slightly larger post.

Manual methods may also be used to activate the winch mechanism. For example, a crank handle and ratchet mechanism could be used in place of the

electric motor, or a single stroke foot driven treadle device, or even a pull rope wrapped on a spring returned drum could be utilised. Or, a simple rope could act directly as a pull-in cable, for a manually closed system.

5 The use of the pull-in cable (6) in conjunction with the main cable (1) provides a gate that is of low cost, is strong, and is considerably more space efficient than conventional gate formats. The small drive mechanism also has very low power consumption characteristics, making it attractive for applications that are power sensitive, and may therefore be battery or solar driven and not just mains driven.

10 Inclusion of a rechargeable operating battery as part of the operating mechanism located inside the master post provides a number of benefits. Firstly, a power fail-safe feature is provided. Typically, the internal battery may be used to operate the gate 400 times, even when external power is lost, before recharge is required. Secondly, the use of a low voltage drive system provides increased
15 safety for installers, operators and maintenance personnel. The installation costs are also reduced, as only low-voltage wiring needs to be run to the post to enable the battery to be recharged. A further advantage is that the battery is now located close to the motor, so losses are reduced, and heavy wiring to the post is no longer required.

20 Conveniently, the battery's level of charge may be maintained through the use of a low-voltage plug-pack (12) located well away (e.g. 100 metres) from the gate, and connected by safe, low-voltage, low-current wiring. Alternatively, a small solar panel which would otherwise be unable to supply enough current to the motor, may be used to maintain the battery's state of charge.

25 That is, the gate is substantially immune to power failure, as the internal battery powers the gate. An external power source can be used to recharge the battery. In this regard the external power source would not be able to provide sufficient power to operate the gate, but is able to recharge the battery over time. This arrangement also improves the security of the gate, as illegal access cannot
30 be gained simply by cutting the power source to the gate.

Location of the motor (8), external to the master post, and driving the internal mechanism through a small access hole, allows for simple upgrade to a higher power motor, should this be required for particular applications. For

example, a larger motor could be used to achieve faster closing times, or to lift heavier cables over longer spans, without change to the internal mechanism.

Due to the low pull-in loads involved, this gate allows the use of lightweight and low cost plastic parts for construction of its operating mechanism. However, most plastic parts are known to "creep" or deform, in the presence of even moderate loads when applied at high temperature. Also, it is desirable for tension on the pull-in cable to be released once the gate is locked, so that movement of the main cable will not act to cause metal fatigue in the pull-in cable. Accordingly, a method has been devised to de-tension the operating mechanism once the gate is locked. This is achieved by very briefly reversing the drive once a locked condition has been detected, without driving so far as to release the gate. This unloads the pull-in cable and overload (tracking) spring, and may even allow the clutch to dis-engage. The main cable load is then taken fully by the latch pin. Some "dead-band" may be easily designed into the operating mechanism to assist this process.

In a preferred embodiment, the winch drive that draws in the pull-in cable (6) may also be used to activate a latch release lever (22) attached to the latch pivot shaft (21) (when driven in the release direction). In this improved release mechanism, the release cable (24) is activated from the pull-in cable winch drum shaft (26), using the principles of a capstan drive. In one embodiment a V-belt system can be used to keep the drive physically small. As can be seen from reference to Figure 3a, when the winch shaft (26) is rotating to draw in the pull-in cable (6) to close the gate, then due to friction on the belt (30), spring A (32) will continue to stretch until the force in spring B (33) approaches zero. By this means the release cable (24) is de-tensioned, allowing the pivoting latch (20) to be returned to its locked position by means of a return spring (23). Thereafter, the winch (25) may continue to reel in the pull-in cable (6), without spring A (32) being further stretched. This is because the V-belt (30) is now able to slip on its pulley (31).

Similarly, when the gate is required to be opened the electric motor and winch shaft (26) (carrying the V-belt pulley), are arranged to rotate in the reverse direction (refer Figure 3b). This causes spring B (33) to be stretched, carrying with it the release cable (24), which then acts on the pivoting latch release lever

(22). This action continues until the latch (22) is able to unlock the main cable end, and until the force in spring A (32) approaches zero. Note that until spring A (32) is de-tensioned, the force that the V-belt (30) may apply to the release cable (24) is extremely high. This is because the tension in the belt (30) will increase exponentially around the pulley (31) (as per the action of a capstan drive). The length of spring A (32) and the release cable (24) is adjusted to ensure that the latch (22) will fully disengage. Thereafter, the winch (25) is able to continue to reel out the pull-in cable (6) (allowing the main cable (1) to drop, thereby opening the gate), without further stretching of spring B (33).

Figure 3a shows how the spring A (32) is stretched under the action of V-belt (30) and pulley (31), as main cable (1) and thimble (7) are being pulled in. Spring B (33) has reached its solid height, and the belt (30) is slipping on the pulley (31) to allow the closing process to continue. Figure 3b shows how the gate is opened when the drive direction is reversed. In this case the spring B (33), is stretched, and the belt (30) acts on the release cable (24) to pull the latch (20) open against its return spring (23). The main cable (1) is released.

The release cable (24) must be strong enough to retract the latch release lever (22), and ideally flexible enough to pass over a pulley. A 1.6 mm diameter stainless steel wire rope has been found suitable for this function. Conveniently, the release cable (6) attached to the release lever (22), passes around a pulley, and through the centre of spring B (33), and is attached to one end of the belt (30). Alternatively, in some arrangements it may be preferable to lengthen spring B (33) such that it is not practical to have a spring B (33) and the release cable (24) anchored at the same, or a similar, position. In these circumstances, the spring B (33) may be angled such that it is anchored at a different location, while still performing the same function. In these circumstances, it is more convenient for the release cable (24) to pass outside of the spring as shown in Figure 3b.

The present invention therefore also provides a means of releasing the latch mechanism (20) using a few small, simple, and inexpensive components, while at the same time providing a very high release force capability and may derive its power from the existing winch drive electric motor (or other) drive mechanism.

As an alternative to the latch mechanism disclosed above, the pulley, belt

and spring arrangement could be replaced with a spool or arm attached to the main drive shaft by means of a ratchet arrangement. The release cable or line would attach to this spool or arm. When operating in the pull-in direction, the ratchet would allow the spool or arm to remain stationary as the shaft turns to draw in the first line. However, when the motion of the shaft is reversed, the ratchet would act to force the spool or arm to rotate with the shaft, thereby winding in and pulling the release line.

Ideally, it is necessary to detect both that the latching pin is in the locked position, and that the cable end (eg. thimble) is correctly in position, to be assured that the gate is fully and correctly locked. It is insufficient to only detect the position of a thimble, as this could occur without the latching pin being in place. Similarly, in the preferred embodiment the latching pin is raised prior to entry of the cable end, and therefore does not indicate a "locked-gate" condition.

It would be possible to utilise separate micro-switches to detect both that the cable end is in place, and that the latching pin is raised. However, this would require additional switch mounting and wiring etc., which is not preferred due to the additional space, wiring, and costs involved. An alternative is to mount a single limit switch onto the pivoting latch pin assembly, arranged to detect the presence of the cable end only when the latch is in the raised position. This method is also not preferred, as the limit switch is exposed to high vibration loads, and its wiring is subject to fatigue failure due to multiple bending.

In the preferred embodiments, the gate will include a sensor to detect when the latch and thimble (7) are in a locked position, such that the drive motor may be disengaged. This can be achieved through the arrangement of Figure 9 which shows how the presence of the thimble (7) can rotate the lock sensing cam (90) against the sensing cam follower (91), causing the follower swing arm (92) to activate the lock micro-switch, thereby signaling the controller (11) that lock has been achieved. Note that lock should not be indicated if either the thimble is not in place, or the latch is not in the locked position, as both of these conditions must be met for the gate to be truly locked.

That is a cam surface carried on the latch pin assembly is generated to form a radius about the pivot point of that pin assembly in the absence of the cable thimble. A spring-loaded cam follower, mounted on a swing arm attached

to the frame of the gate mechanism, is arranged to just clear this cam surface. However, if the cable thimble is in place when the latch pin is raised, the cam is caused to rotate to a position outside of the original radius. This in turn causes the cam follower to be activated, which motion may be easily sensed using a fixed micro-switch.

This therefore allows for the use of a single, fixed, micro-switch to reliably detect both that the latch is in the locked position, and that the cable thimble is in place.

To ensure that the locking thimble (7) will enter the master post (5) correctly, then ideally the thimbles located at either end of the main cable (1) should be oriented at right angles to each other. This is difficult to achieve when manufacturing the cables. However, it has been found possible to achieve the ideal configuration through the use of a length of hollow tube, split longitudinally at each end, that is clamped onto the cable. By slightly unwinding the cable strands until the thimbles have the correct orientation, then clamping the split ends onto the cable, the ideal relationship may be achieved. Conveniently, this hollow tube may also perform the function of the spreader bar (10), used for the first tracking means.

During development it was found that a point is reached during the opening cycle, once sufficient chain or cable (1) has reached ground level, when friction between the cable (1) and the ground (4) (or road surface) will hold the remaining chain or cable (1) away from the passive post (2) and thereby results in the opening width for traffic flow between the gateposts (2, 3) being effectively reduced.

In the preferred embodiment, and referring to Figures 4a and 4b, as the main cable (1) is lowered by the master post (3), a counter-weight (41) inside the passive post (2) is able to pull in the cable (1) against that post (2). This may be achieved via a small access hole (43) in the passive post (2), a counter-weight cable (9), and one or more small pulleys (44). Similarly, as the main cable is raised to close the gate, tension in that cable (1) acts through the counter-weight cable (9) to raise the counter-weight (41) to its normal (closed gate) position. A spreader bar (10) attached to the cable (1) can further improve the ability of the main cable to track along the side of the passive post (2), ensuring that the cable

(1) is drawn well into position adjacent to the post (2), for the full height of that post (2), thereby providing a greater effective opening between the posts.

In an alternative arrangement springs may be used in place of the counterweight (41), however, in the preferred embodiment a counterweight is used.

5 Operation of the counterweight system (refer to Figs 4a and 4b) is a little subtle, and works better than the spring alternative. Firstly, with the gate in the raised position the counterweight cable tension is applied obliquely to the main cable (1), thereby having less effect on the symmetry of the main cable (1) than if loading the cable at right angles. When the gate is first released, the
10 counterweight (41) commences to accelerate rapidly downward and develops a high velocity. Then, when the main cable (1) falls to the ground, the combined action of both the weight of the counterweight (41), and its now considerable inertia acting at near right angles on the spreader bar (10), is used to draw the main cable neatly up against the passive post (2).

15 A further alternative is to include a bar as part of the cable. That is, the cable can be connected to a bar which is pivotally attached to the post (2). The cable (1) and the bar then combine to extend across the opening. When the cable is released, the weight of the bar would assist in causing the bar to pivot down along the side of the post (2), thereby drawing the cable (1). Alternatively,
20 rather than being pivotally attached to the post (2), the bar could be joined to the post by a length of cable attached to the post and the bar.

As previously noted conventional gates are slow to open. In a preferred embodiment the present invention provides a gate having safe, short opening times. This can be achieved as no hazard is presented by rapid opening of the
25 gate, and gravity may be utilised to effect the short opening time.

In the arrangement shown in Figure 5a, the winch drum (25) is made free to rotate on the driven shaft (26). A separate drive collar (50) is attached to the shaft (26) in such a manner that it is forced to rotate with the drive shaft (26), but is free to slide along part of its length. In the preferred embodiment, the collar
30 (50) is located on the shaft (26) by means of a pin (51) passing through a slot (52) in that shaft (26). Alternatively, however, a spline joint or similar arrangement could be provided. This drive collar (50) is provided with extending dogs (53) that may be engaged into recesses (54) in one of the winch drum (25) end flanges,

and a spring (55) is used to hold the winch drum (25) and drive collar (50) apart. This provides a form of dog clutch between the motor driven shaft (26), and the winch drum (25).

The opposite side of the drive collar (50) is provided with extending cam followers (56), which engage with a face cam and hub assembly (57) also mounted on the drive shaft (26). The face cam and hub assembly (57) is also free to rotate on the drive shaft (26), but only over a limited range of travel. This may conveniently be done by providing travel limit surfaces (58), against which the cam followers (56) are able to react (refer Figure 5c). By applying a suitable
10 retarding force (eg. via a friction brake block, or similar), the face cam (57) will be prevented from rotating as the drive shaft rotates, causing it to remain stationary until its travel limit (58) is reached relative to the drive collar (50). Thereafter, the face cam (57) and drive shaft (26) will rotate together. As will be seen, this cam arrangement is used to automatically engage and disengage the winch clutch.
15 Conveniently the face cam (57), and the V-belt pulley (31) previously described, could be manufactured as one unit. By this means the V-belt pulley (31) is able to provide the necessary cam retarding force, thereby doing away with the need for a separate retarding system. It will be appreciated that other arrangements to engage the clutch are also possible, and the various cam and clutch elements
20 could equally be swapped between components. For example, the clutch dogs could form part of the winch drum, and the clutch recesses could be manufactured in the drive collar.

In the preferred embodiment, and starting with the gate fully open, this quick release improvement operates as follows.

25 Referring to Figure 3a, the motor drive will commence rotating the drive shaft (26) anti-clockwise, and the V-belt pulley (31) and face cam (57) assembly will rotate with the shaft (26) and drive collar (50) until the forces in springs A (32) and B (33) become approximately equal. As further rotation occurs, the face cam (57) will tend to be held stationary by the V-belt pulley (31). However, the drive
30 shaft (26) and drive collar (50) will continue to rotate (refer Figure 5b). Therefore, the drive collar cam followers (56) will be caused to move up the ramp of the face cam (57), forcing the drive collar (50) to slide along the drive shaft (26) towards the winch drum (25) (refer Figure 5c). By this means, the clutch dogs (53) are

caused to engage with the respective recess (54) of the winch drum (25). This forces the winch drum (25) to be rotated, drawing in the pull-in cable (6). The travel limits (58) on the face cam (57) prevent the cam followers (56) from travelling beyond the point of maximum lift and force the pulley (31) to rotate with the other components. This causes spring A (32) to stretch, allowing the latch (20) to remain closed.

From this point the drive shaft (26), face cam (57), V-belt pulley (31), drive collar (50), and winch drum (25) all continue to rotate as one. This process continues until the main cable (1) is locked into the master post (3) by the latch assembly (20), at which time the gate control system (11) stops the drive motor (8).

To cause a very rapid opening of the gate, the control system starts the drive motor (8) in the opposite (in this case clockwise) direction (refer Figure 3b), when the following sequence of actions occur.

Firstly, the spring forces equalise as all components rotate as one, and the pull-in cable (6) tension is released. However, the main cable (1) is not released at this time. Next, the V-belt pulley (31) and face cam (57) assembly is again held stationary as the drive shaft (26) and collar (50) continue to rotate. This allows the cam followers (56) to move down the cam faces (57), thereby allowing the clutch spring (55) to disengage the clutch dogs (53) from the winch drum (25). Finally, however, the face cam travel limits (58) are again reached, and the face cam (57) and V-belt pulley (31) assembly is caused to commence to rotate although the winch drum (25) is free. This action causes spring B (33) to be stretched, and the V-belt (30) to pull the latch release cable (24), thereby unlatching the main thimble (7) and cable (1). The control system (11) can stop the motor drive (8) at this point. Because the winch drum (25) is now free to rotate, the main cable (1) rapidly falls away under the action of gravity, towing the pull-in cable (6) with it. This completes the entire closing and opening cycle.

In summary, in a "neutral" or unloaded condition, both the balance springs (32, 33) are under tension. These apply load to each end of the V-belt (30), which is wrapped around the main drive pulley (31). Referring to Figure 10A which exemplifies the "unlocking action". Here, a significant spring tension is being applied to the V-belt at point "V", and the pulley is being rotated clockwise

(by the main drive shaft (26)). Under this condition, the V-belt (30) is able to develop an extremely large tension force at point "W", due to an exponential increase of force as the belt (30) wraps around the pulley (31). A "latch release cable" (24), shown at "X", may generate a very high force, if necessary, to release
5 the gate latch (20)

Similarly, when the pulley (31) is rotated anti-clockwise, a point is reached when spring B (33) collapses to its solid height ("Y"), and spring A (32) has stretched to point "Z". Spring B(33) will then be exerting very little tension on the V-belt (30), approaching zero. The V-belt (30) will then commence to slip on the
10 pulley (31), while spring (32) remains stretched to point "Z". The drag torque on the pulley (31) will be approximately the force at "Z", times the pulley radius.

During opening of the gate, as the winch drum (25) is free to rotate, it has been found that a brake block (60) applied to the winch drum (25), is useful to prevent uncontrolled reeling of the pull-in cable (6). Refer to Figure 6. Spring
15 tension may be used to apply the brake force. In addition, a separate finger assembly (61) may be used to clamp the pull-in cable (6) against the winch drum (25), to keep the cable (6) tightly coiled on that drum (25). This helps the cable (6) to reel evenly, thereby prolonging it's operating life. Conveniently, a single spring (64) may be used for applying force both to the brake block (60), and to the
20 coiling control finger (61) unit. Figure 6 shows one format of this arrangement which both brakes the winch drum (25) and keeps the pull-in cable (6) tightly and neatly wound on the winch drum (25).

It has been found that longer main cable spans require greater braking forces to achieve optimum gate performance. A brake spring (64) that is too
25 strong will prevent the cable from falling fully to ground level, whereas too weak a spring will draw excess pull-in cable (6) from the mechanism. Accordingly, a small number of springs of differing wire diameter have been made, to cover the range of cable spans.

The above quick release mechanism uses a small fraction of the V-belt
30 drag torque to actuate the clutch. As the torque is increased, the pulley (31) is retarded, carrying with it the cam faces (57). In turn, the drive collar (50) is forced along the shaft (26) (as it is unable to rotate on the shaft (26)) by the associated cam followers (56). This engages the clutch, which then commences rotation of

the winch drum (25), reeling in the "pull-in" cable (6). A spring (55) is utilised to disengage the clutch following this stage.

In some environments, the above configuration may not be optimum. For example, if the pulley (31) were to become excessively tight on the shaft (26) for any reason, or the collar (50) prevented from easily sliding along the shaft (26) (e.g. due to sand contamination), then a point may be reached when the V-belt (30) commences slipping (at "Z"), before the clutch (53) has engaged. In this circumstance, the drive (26) would continue to rotate, but the winch drum (26) would not be rotated to reel in the "pull-in" cable (6). Accordingly, the gate would fail to lock. Alternatively, the clutch may fail to disengage if the collar (50) becomes jammed with sand.

Whilst, in some circumstances, a shroud around the operational components may be sufficient protection from environmental contamination or the like, in extreme conditions an alternative arrangement, as shown in Figures 7a to 7c, may be adopted. In this arrangement, the main pulley and clutch dogs are integrated into one unit (70), which is free to slide along the main drive shaft (26), but forced to rotate with it. This is accomplished by machining a slot (72) in the shaft, through which a pin (71), pressed into the pulley (70), passes. Although other arrangements would be known to the person skilled in the art, for example, a sliding keyway.

At least two cams (73, 74) and two reaction plates (75, 76) are provided for this arrangement. One cam (73) and reaction plate (75) act to engage the clutch, and the other set (74, 76) to disengage the clutch. The cams (73, 74) are rigidly attached to the V-belt (77). The "disengage" cam is the same as the "engage" cam, but reversed on the V-belt (77).

Figure 7a shows a cross-section of the alternative clutch system. The combined poly-V belt pulley and clutch dog collar (70), is forced to rotate with, but free to slide along, the drive shaft (26). Figure 7b shows the clutch disengaged from the winch drum (25) such that the winch drum (25) is therefore free to unreel the cable (6) for the "quick release" function. The disengage cam (74) acts against its' reaction plate (76) to hold the clutch dogs (70) out of engagement. Referring to Figure 7c the belt (77) drives the engage cam (73) against the beveled edge of the engage reaction plate (75) to force the combined pulley and

dog collar (70) along the shaft (26) into clutch engagement. Thereafter the belt (77) slips on the pulley (70) and the pull-in cable (6) is able to reel in, to lock the gate. The reverse drive direction forces the clutch to disengage to release the winch (by the same action), and the belt to open the latch (as previously described)

In the previous embodiment, the V-belt pulley (31) was free to rotate about (over a limited range of travel), but not to slide along the main drive shaft (26). This pulley (31) carried with it one or several face cam (57) surfaces. A separate drive collar (50) carried cam followers (56) on one face, and clutch dogs (53) on the other. This collar (50) was made free to slide along, but not rotate about the drive shaft (26), and arranged so that the cam followers (56) would engage with the pulley-supported cams (57). By this means, the action of the belt (30) on the pulley (31) would force the clutch dogs (53) into engagement with a winch drum (25) when rotated in one direction, but allow a spring (55) to disengage the clutch when operated in the other direction.

The alternative arrangement provides a clutch action which is far more positive. In this arrangement, the pulley (70), which may conveniently be made of aluminium, carries with it the clutch dogs. The pulley (70) is made free to slide along, but is forced to rotate with the drive shaft (26). At least two cams (73, 74) are directly attached to the belt (77), at least one to engage the clutch, and at least one to disengage the clutch. These cams (73, 74) act against "reaction plates" (75, 76).

Referring to Figure 7b which clearly shows the clutch dog out of engagement with the winch drum. If the pulley (70) is now rotated (refer Figure 7c), it is clear it will carry with it the belt (77), and the associated cams. The "engage" cam (73) will act against its reaction plate (75), thereby forcing the pulley and clutch dogs (70) along the shaft (26), to engage with the winch drum (25). Note that the "disengage" (74) and "engage" (73) cams must have clearance between their operating zones, to avoid jamming. That is, the disengage cam (74) must be in the process of moving out of the way before the engage cam (73) starts moving the pulley (31) along the shaft. The reverse also applies.

A further improvement has been to have the flanks of the cams extend

down each face of the pulley. This causes the cam actuating loads in the axial direction, to be carried directly from the cams to the pulley, rather than via the belt. As these forces may be quite high in some circumstances, this improvement acts to improve belt strength and life, and to prevent the belt from being lifted or
5 twisted from the pulley.

For convenience, the V-belt may be replaced with a poly V-belt, which simplifies the means of attachment of the cams to the belt, as well as allowing a significant improvement to the way the springs may be attached.

Whilst this arrangement is more expensive to manufacture than the
10 alternative arrangement, this clutch design does provide a more positive clutch action. Recalling the capstan principle, it becomes clear that the belt is able to exert a very large force onto the cams, ensuring the clutch will both engage, and disengage as required.

Referring to Figures (7C) and 10B as the pulley (31) rotates anti-clockwise
15 we see the engage cam (73) will be strongly forced around the pulley (70) (by the belt (77)), until the spring B (33) closes to its solid height (and "unloads" the belt). But the belt (77) will not be able to unload until the cam (73) has reached its final position, alongside its corresponding reaction plate (75). At this point, the clutch must be engaged.

20 The reverse applies. The disengage cam (74) must disengage the clutch before balance spring A (32) can become unloaded.

Such a quick release system could result in the gate opening in less than one second. It would not be practical to provide this level of performance in a conventional gate system. Further, this arrangement saves a considerable power
25 consumption, allowing the gate to be utilised in applications which are power sensitive. In the preferred embodiment, the inclusion of the quick release mechanism also improves the operation of the counterweight mechanism. As the main cable (1) rapidly drops following release, it initially allows the counterweight (41) to almost "free fall" building up a high speed. Because of this speed, when
30 the main cable (1) reaches the ground, the inertia of the falling counterweight (41), in combination with its weight, is very effective in drawing the main cable (1) up tight to the passive post (2), thereby ensuring the maximum opening of the gate.

In order to operate smoothly, it is highly preferable for the main (1) and pull-in (6) cable to run centrally into the master post (3), but for the winch drum (25) to be located with considerable offset from the centre line. This arrangement provides better internal space for the various other gate mechanisms. Further, the pull-in cable (6) should be fed onto the winch drum (25) in such a manner that it reels on neatly and evenly.

Additionally, it is useful for the gate control system (11) to be able to sense an overload condition, thereby allowing appropriate control action to be taken in this event.

Referring now to Figures 8a and 8b, in order to achieve this a simple fixed pulley (81) is used to re-direct the pull-in cable (6) (from the centre-line) around a second pulley (82) mounted on a spring-loaded swinging arm (83). By this means, at low loads the pull-in cable (6) alignment may be offset to one side of the winch drum (25), but as the cable load increases then the swinging arm (83) will pivot about an overload pivot (80) to cause the pull-in cable (6) to track across the winch drum (25) surface. A limit stop is ideally provided to establish the minimum load position, and the selected spring (84) characteristic determines the rate at which the cable is offset verses load. A limit switch (85), for example an overload micro-switch, may be provided to detect abnormally high cable loads, and used as an input to an associated control system able to cut power to the drive, re-open the gate, or take other appropriate control action.

It is a characteristic of the cable gate of the preferred embodiment, that the pull-in load required to close the gate will initially be small, but will increase to a maximum level once the gate is fully closed. Similarly, the cable should be tracked across the winch drum at the rate of one cable width per drum rotation.

Through the selection of an appropriate spring design, the present invention is able to approximately match these two characteristics. That is, as cable is reeled in and the main cable is raised, then the increasing cable tension forces will cause the cable to be tracked across the winch drum at an approximately correct rate. Therefore, the cable will be reeled in neatly and evenly, and abnormally high loads will be detected by the limit switch.

Figures 8a and 8b show the action of this second tracking system, and overload sensing. As the cable load increases, the overload swing arm (83)

rotates to track the pull-in cable (6) across the winch drum (25) surface. If excessive load is encountered, the arm moves against a limit switch (85) which is able to signal the control system to take appropriate action.

Conveniently, the operating mechanism may be constructed as a complete, pre-tested, self-contained module. This approach simplifies and reduces the cost of maintenance activities, as the module may be replaced in the field, and repaired in a suitable workshop. To allow easy and rapid module replacement, while still preventing unauthorised access, and also supporting the very high loads that are developed should attempts be made to breach the gate, a locking plate system was developed. Firstly, the heavily constructed top plate (27) of the module is arranged to fit into the entry mouth hole in the master post (refer Figure 3a). Then, high strength bolts (89) are fitted, from the inside, through holes in the top plate, and the post. A locking plate (88) is arranged to drop over a tang (87) welded to the top plate, between the bolt heads, so as to prevent withdrawal of the bolts. Finally, a padlock (86) is fitted to this tang, to prevent the removal of the locking plate.

Referring to Figures 8A and 8B, with the locking plate and padlock in place, the retaining bolts (89) may not be removed, so the top plate (27) and associated operating module may not be accessed.

The main cable (1) may typically be retained in the passive post (2) by means of a heavy steel anchor pin (40) (refer Figure 4b). Removal of this pin (40) allows the main cable (1) to be lowered to the ground (4) thereby providing for emergency access in the event of failure of the main drive mechanism. To prevent unauthorised access, this pin (40) may in turn be held in place through the use of a padlock (46). An arrangement has been devised that achieves the above objectives, whilst conferring several other advantages. In this arrangement, the anchor pin (40) passes through a hole in one side of the post (2), and into a "blind" recess (47), located on the other side of the post (2). The padlock (46) is then locked into a cross-hole (48), in the anchor pin (40) located inside the post (2), to prevent withdrawal of the pin (40). By this means, the padlock (46) is at least partly protected from deliberate abuse, and is sheltered from the weather. Also, access to the anchor pin (40) is restricted, preventing it from being driven against the hasp of the padlock (46).

In certain applications, the functionality of a cable gate may be enhanced using multiple cables, signs, and panels etc. These additional features would be attached to (or may form part of) the main cable, and could be raised by it. The only requirements should be that the attached components must allow the main cable to slide through them, they must collapse fully to ground level, and they must be compatible with the passage of vehicular traffic over them.

For example, horizontal and vertical cables may be attached, or a sign may be hung from the centre of the gate span (so that vehicle wheels could track either side of the sign). A second (or more) cable(s) may be anchored near the base of both the master and passive posts, and raised by vertical tie cables attached to the main cable by sliding joints. When opened, the main cable would slide through these vertical ties, allowing the entire assembly to drop to the road surface.

Alternatively, the main cable may be anchored at a low point on the master post, but pass through pulleys spaced apart in the passive post, to return to the normal latch position on the master post. When opened, the entire cable would thereby be allowed to drop to ground level.

Some slack must be provided in the main cable so that it may be locked, and is also beneficial should attempts be made to breach the gate due to the way the cable tension acts to retard the vehicle. However, for reasons of safety the cable should ideally not be so high as to allow it to pass over the hood of a vehicle, nor so low that a heavy 4WD vehicle may drive over it. It has been found optimum to support the ends of the cable about 750 millimetres above ground level, with the centre of the cable drooping to about 550 millimetres above the ground.

Modifications and variations to the cable gate of the present invention may be apparent to one skilled in the art upon reading of this disclosure and such modifications and variations form part of the scope of the present invention.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A gate for controlling passage through an opening including:
a first support means located on one side of the opening;
a second support means located on the other side of the opening;
at least one elongate member, having a first and a second end, extendable across the opening between said first and second support means; and
a control means for releasing said at least one elongate member to thereby enable passage through said opening, and drawing in said elongate member to thereby restrict passage through said opening.
2. A gate as claimed in claim 1 wherein said elongate member is a cable, chain, rope, cord, rod or pipe provided with flexible end fittings.
3. A gate as claimed in claim 1 or claim 2 wherein said first and/or said second support means are posts.
4. A gate as claimed in any preceding claim wherein said control means is located substantially wholly within one of said first or second support means, to thereby limit access to said control means.
5. A gate as claimed in any preceding claim further including a first line connecting said first end of said at least one elongate member to a first winch means such that said first winch means operates to draw in said first line thereby drawing in said at least one elongate member.
6. A gate as claimed in claim 5 wherein said first line is a steel or synthetic cable or strap.
7. A gate as claimed in any preceding claim wherein said elongate member is a 10mm stainless steel wire rope.
8. A gate as claimed in any preceding claim wherein said first line is a 1.6mm stainless steel wire rope.
9. A gate as claimed in any preceding claim further including a locking means to prevent unwanted release of said at least one elongate member.

10. A gate as claimed in claim 9 wherein said locking means includes a latch means adapted to engage a thimble assembly attached to said at least one elongate member.

11 A gate as claimed in claim 10 wherein said latch means is a pivoting pin.

12. A gate as claimed in claim 10 or claim 11 wherein said first line is attached to said thimble assembly.

13. A gate as claimed in any one of claims 10 to 12 further including a latch release means including:

- a release lever adapted to release said latch means;
- a first and a second spring each fixed at one end;
- a belt passing around a pulley means and connecting said first spring to said second spring; and
- a release line attached to said release lever and said belt.

14. A gate as claimed in claim 13 wherein said latch release means is activated by said first winch means.

15. A gate as claimed in claim 13 or 14 wherein said release lever further includes a return spring adapted to return said release lever to a locked position.

16 A gate as claimed in any one of claims 13 to 15 wherein said release line is a 1.6mm stainless steel wire rope.

17. A gate as claimed in any one of claims 13 to 16 wherein said winch means includes a winch drum fixed to a drive shaft.

18. A gate as claimed in any one of claims 13 to 16 wherein said winch means includes:

- a winch drum adapted to freely rotate on a drive shaft;
- a drive collar rotatable with, and slidable along, said drive shaft;
- an engaging means adapted to enable said drive collar to engage and disengage said winch drum to thereby activate said latch release means.

19. A gate as claimed in claim 18 wherein said drive collar is located on said drive shaft by a pin extending through a slot in said drive shaft.

20. A gate as claimed in claim 18 or claim 19 wherein said engaging means includes cooperating extending dogs and recesses on said drive collar and winch drum.

21. A gate as claimed in any one of claims 18 to 20 further including a third spring adapted to hold said drive collar and winch drum out of engagement.

22. A gate as claimed in any one of claims 18 to 21 wherein said pulley means further includes a face cam adapted to engage said drive collar, such that any imbalance between said first and second spring acts to hold said face cam stationary, and said drive collar is forced by said face cam to move along said drive shaft to thereby engage or disengage said winch drum.

23. A gate as claimed in claim 22 wherein said face cam includes a ramp adapted to cooperate with protrusions on said drive collar.

24. A gate as claimed in claim 10 wherein said latch means includes a latch or locking pin adapted to be released by a release lever; a member attached via a ratchet means to a winch means; and a release line joining said release lever to said member.

25. A gate as claimed in any one of claims 13 to 16 further including a clutch means including:

- an assembly adapted to slide along and rotate with a drive shaft; said assembly including a pulley and clutch dog;

- a plurality of cams, including a first and second cam;

- a plurality of reaction plates, including a first and second reaction plate; wherein said first cam is adapted to engage said first reaction plate, to thereby engage said clutch dog with a winch means; and said second cam is adapted to engage said second reaction plate, to thereby disengage said clutch dog from said winch means.

26. A gate as claimed in claim 25, wherein flanks on said cams extend down each face of said pulley.

27. A gate as claimed in any one of claims 10 to 26, further including a lock detect means adapted to sense when said gate is locked.

28. A gate as claimed in claim 27 wherein said lock detect means includes a sensor to detect when said latch means and said thimble assembly are both in a locked position.

29. A gate as claimed in claim 28 wherein said sensor is activated by said thimble assembly pivoting a sensing cam, mounted on said latch means, into engagement with said sensor.

30. A gate as claimed in any one of claims 5 to 29, wherein once said gate is locked, said winch means is briefly activated in the unlock direction, without unlocking said gate, to thereby release tension on said first line.

31. A gate as claimed in any one of claims 5 to 30 wherein during opening of the gate said winch means is able to freely rotate, thereby allowing the weight of said at least one elongate member to unreel said first line from said winch means.

32. A gate as claimed in claim 31 further including a braking means to limit the speed of said winch drum when not engaged with said drive collar.

33. A gate as claimed in claim 32 wherein said braking means includes a resilient means.

34. A gate as claimed in claim 32 or claim 33 further including a finger assembly adapted to hold said first line against said first winch means.

35. A gate as claimed in any preceding claim wherein said second support means further includes a first tracking means to draw said at least one elongate member towards said second support means during release of said at least one elongate member.

36. A gate as claimed in claim 35 wherein said first tracking means includes an aperture in said second support means through which a first counterweight line may pass, one end of said first counterweight line being attached to said at least one elongate member, and the other end attached to a first counterweight.

37. A gate as claimed in claim 36 wherein said aperture is located a predetermined distance below said at least one elongate member and

substantially equal to the distance between said second support means and a point where said first counterweight line is attached to said at least one elongate member.

38. A gate as claimed in any preceding claim wherein said at least one elongate member further includes at least one bar running along an end portion of said at least one elongate member, to thereby assist in the tracking of said at least one elongate member along a side of said second support means.

39. A gate as claimed in claim 38 wherein each, or a selection of each, elongate member includes at least one bar running along said end portion of the respective elongate member.

40. A gate as claimed in any preceding claim wherein said at least one elongate member is connected to a bar pivotally attached to said second support means.

41. A gate as claimed in any one of claims 1 to 34 wherein said first and/or second support means further includes a resilient means to draw said at least one elongate member towards said first and/or second support means during release of said at least one elongate member.

42. A gate as claimed in any one of claims 17 to 41 further including a second tracking means to track said first line along said winch drum including:

a fixed pulley;

a second pulley mounted on an arm, said arm being spring loaded and capable of swinging;

wherein said first line tracks around said fixed pulley and said second pulley prior to being wound on to said winch drum.

43. A gate as claimed in claim 42 wherein said second tracking means further includes a first limit stop to indicate a minimum load position.

44. A gate as claimed in claim 43 wherein said spring loaded arm holds said second pulley at said first limit stop when said gate is fully opened.

45. A gate as claimed in any one of claims 42 to 44 wherein said second tracking means further includes a second limit stop adapted to detect an overload

condition.

46. A gate as claimed in claim 45 wherein said second limit stop includes a sensor activated by said spring loaded arm and/or said second pulley.

47. A gate as claimed in any one of claims 5 to 46, further including a third line connecting said second end of said at least one elongate member to a second winch means such that said second winch means operates to draw in said third line thereby drawing in said at least one elongate member.

48. A gate as claimed in claim 47 wherein said third line is of the same construction as said first line.

49. A gate as claimed in claim 47 or claim 48 wherein said second support means is constructed the same as said first support means.

50. A gate as claimed in any preceding claim wherein at least one drive motor to enable said at least one elongate member to be drawn into said first and/or said second support means is located substantially wholly within said first and/or second support means, to thereby limit access to said at least one drive motor

51. A gate as claimed in any preceding claim wherein said first and second ends of said at least one elongate member are held approximately 750mm above the ground when in a locked position.

52. A gate as claimed in any preceding claim wherein said at least one elongate member is held approximately 550mm above the ground in the approximate middle of said opening when in a locked position.

53. A gate as claimed in any preceding claim wherein said first and/or second support means include a security lock system to prevent access to parts within said first or second support means, said security lock system including:

- a top plate adapted to fit within said first or second support means;
- at least one locking pin adapted to pass through said top plate and said first or second support means;
- a locking plate adapted to fit over a tang mounted on said top plate and prevent removal of said at least one locking pin; and
- a second locking means fitted to said tang to prevent removal of said

locking plate.

54. A gate as claimed in claim 53 wherein said at least one locking pin is a high strength bolt, and said second locking means is a padlock.

55. A gate as claimed in any preceding claim further including a battery located wholly within said first and/or second support means to enable operation of said gate.

56. A gate as claimed in claim 55 further including an external power source connected to said battery and capable of recharging said battery.

57. A gate as claimed in claim 56 wherein said external power source is mains power or a solar power source.

58. A gate as claimed in any one of claims 10 to 57 wherein said first end and said second end of said at least one elongate member are each attached to respective thimble assemblies, and said locking means includes respective latching means in said first and second support means to engage the respective thimble assemblies.

59. A gate as claimed in claim 58 wherein said first line and said third line are each attached to the respective thimble assemblies.

60. A gate as claimed in any preceding claim further including a hollow tube, split longitudinally at each end, and clamped onto said at least one elongate member.

61. A gate as claimed in claim 60 when appended to claim 10 wherein said thimble assembly is orientated prior to clamping each end of said hollow tube.

62. A gate as claimed in claim 60 when appended to claim 38 wherein said at least one bar is said hollow tube.

63. A gate as claimed in any preceding claim wherein said second end of said at least one elongate member is anchored to said second support means by a removable pin.

64. A gate as claimed in claim 63 wherein said removable pin is held in said second support means by a third locking means.

65. A gate as claimed in claim 64 wherein said third locking means is a padlock.

66. A gate as claimed in any preceding claim wherein said padlock(s) are located within said first or second support means.

67. A gate as claimed in any preceding claim wherein said at least one elongate member, when in a locked position, is allowed to sag whilst still restricting passage through said opening.

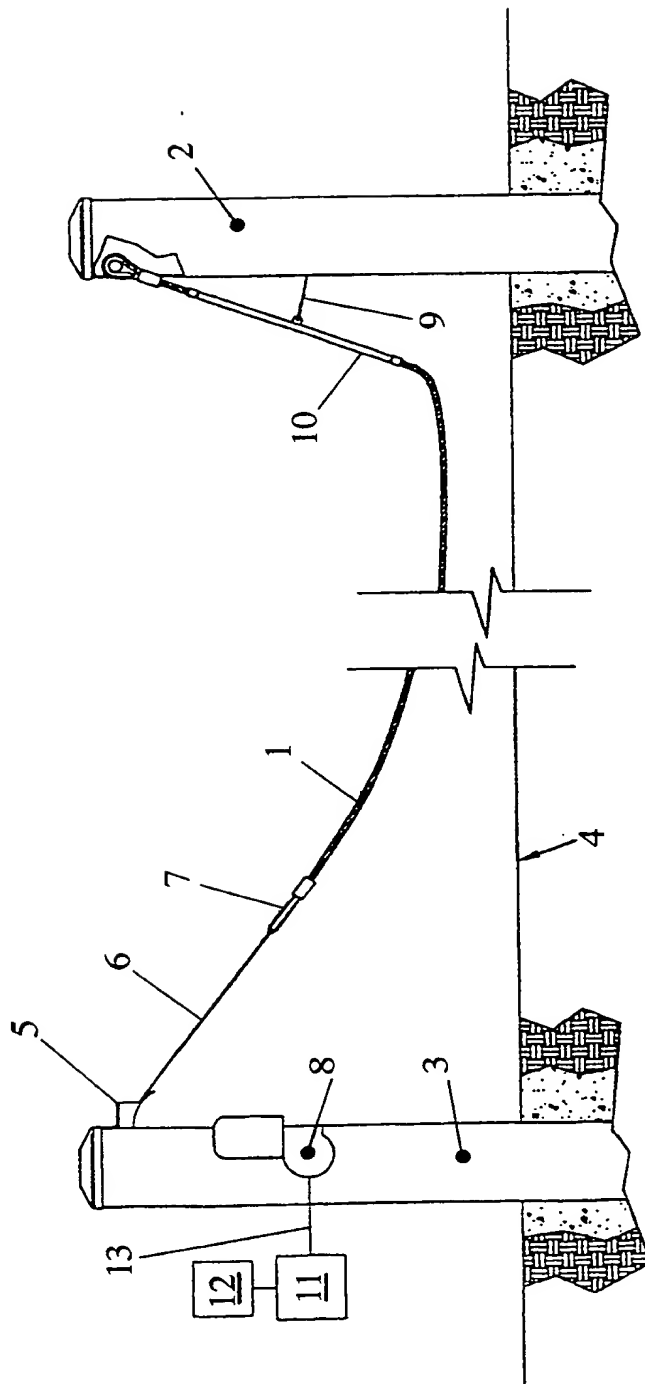
68. A drive mechanism including:
a first and a second spring each fixed at one end;
a belt passing around a pulley means and connecting said first spring to said second spring;
a drive means to rotate said pulley means; and
a line attached from said belt to a device which said drive mechanism is adapted to operate.

69. A gate substantially as hereinbefore described with reference to the accompanying drawings.

70. A method of operating a gate substantially as hereinbefore described with reference to the accompanying drawings.

1/14

Fig 1.



2/14

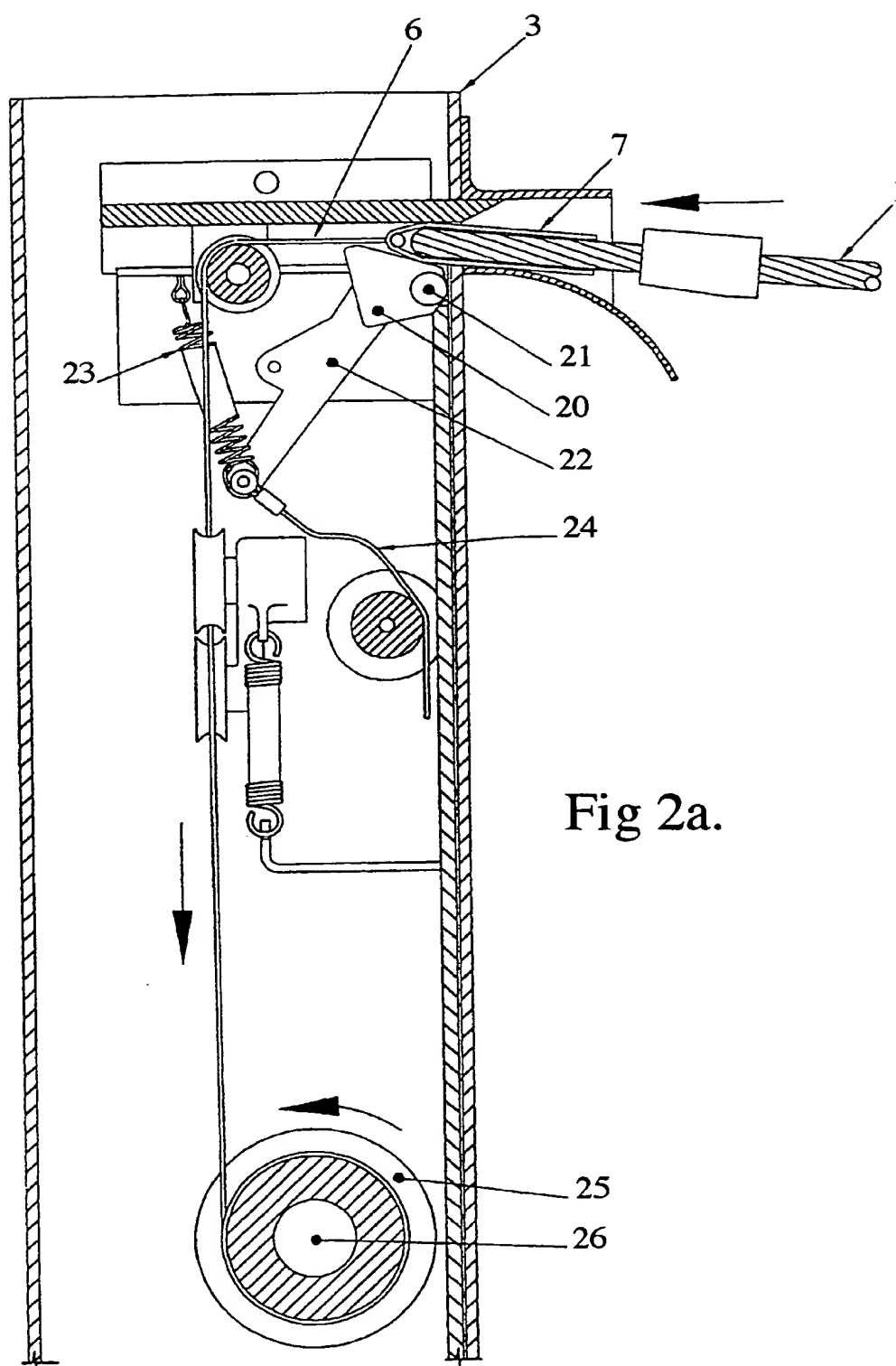


Fig 2a.

3/14

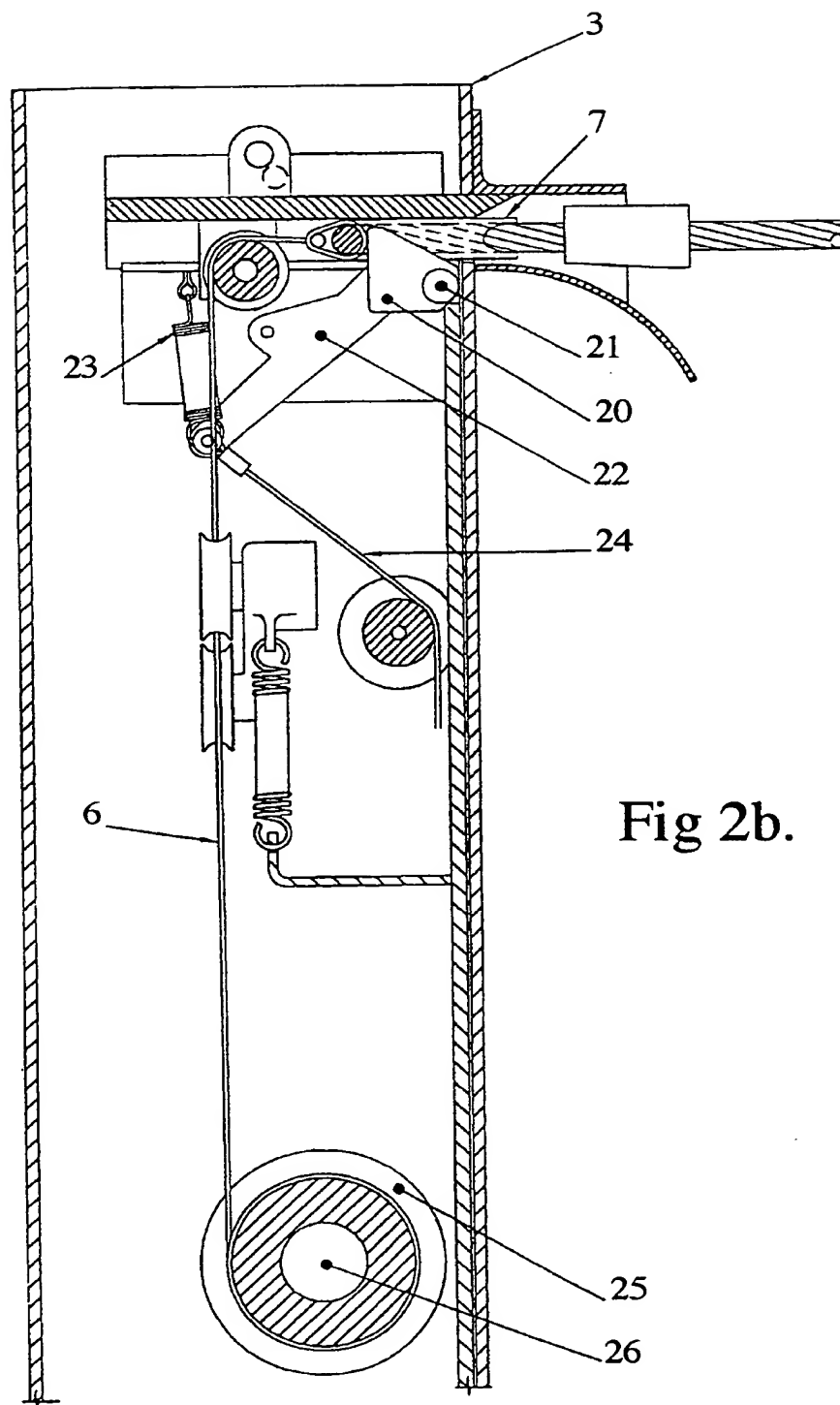


Fig 2b.

4/14

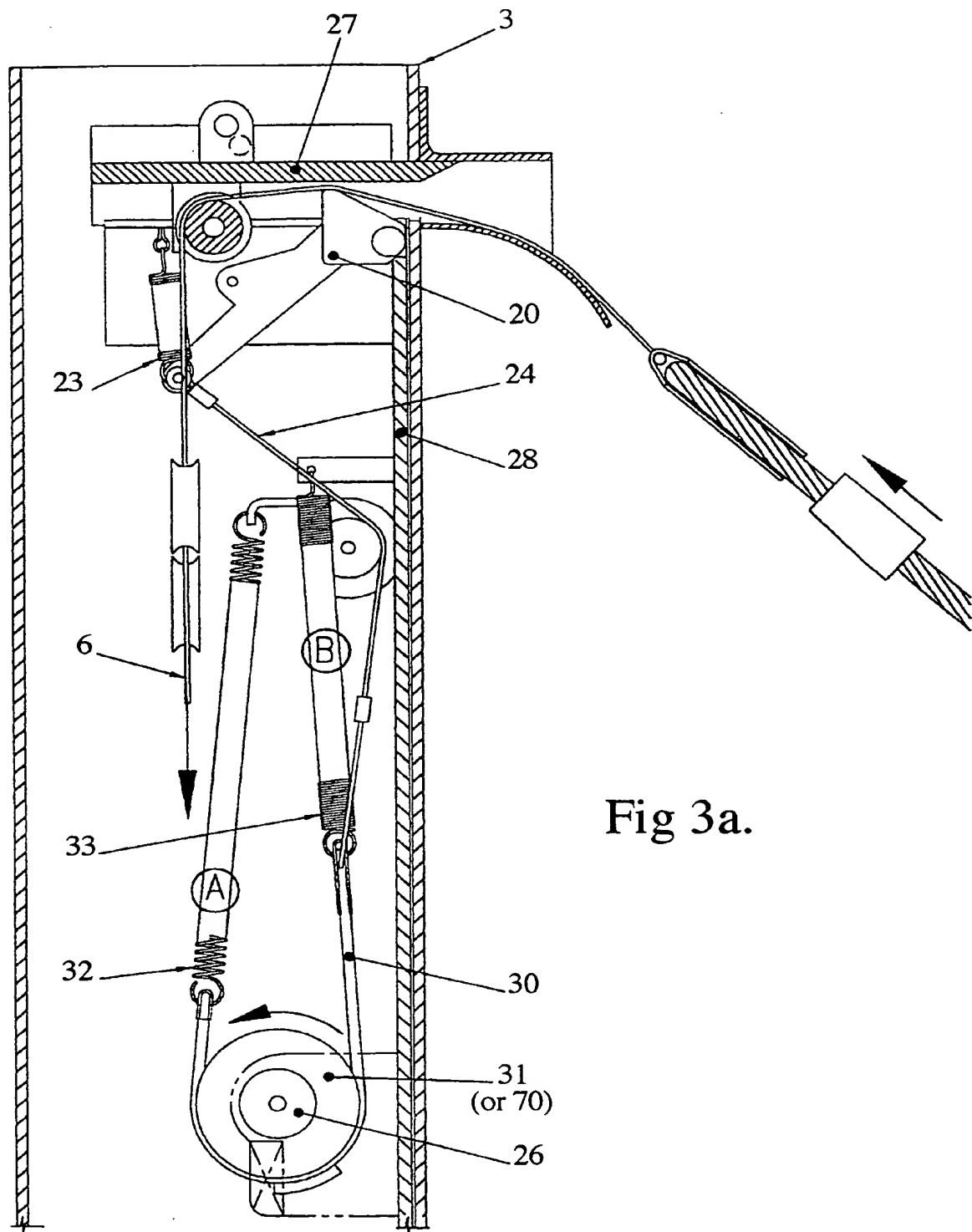


Fig 3a.

5/14

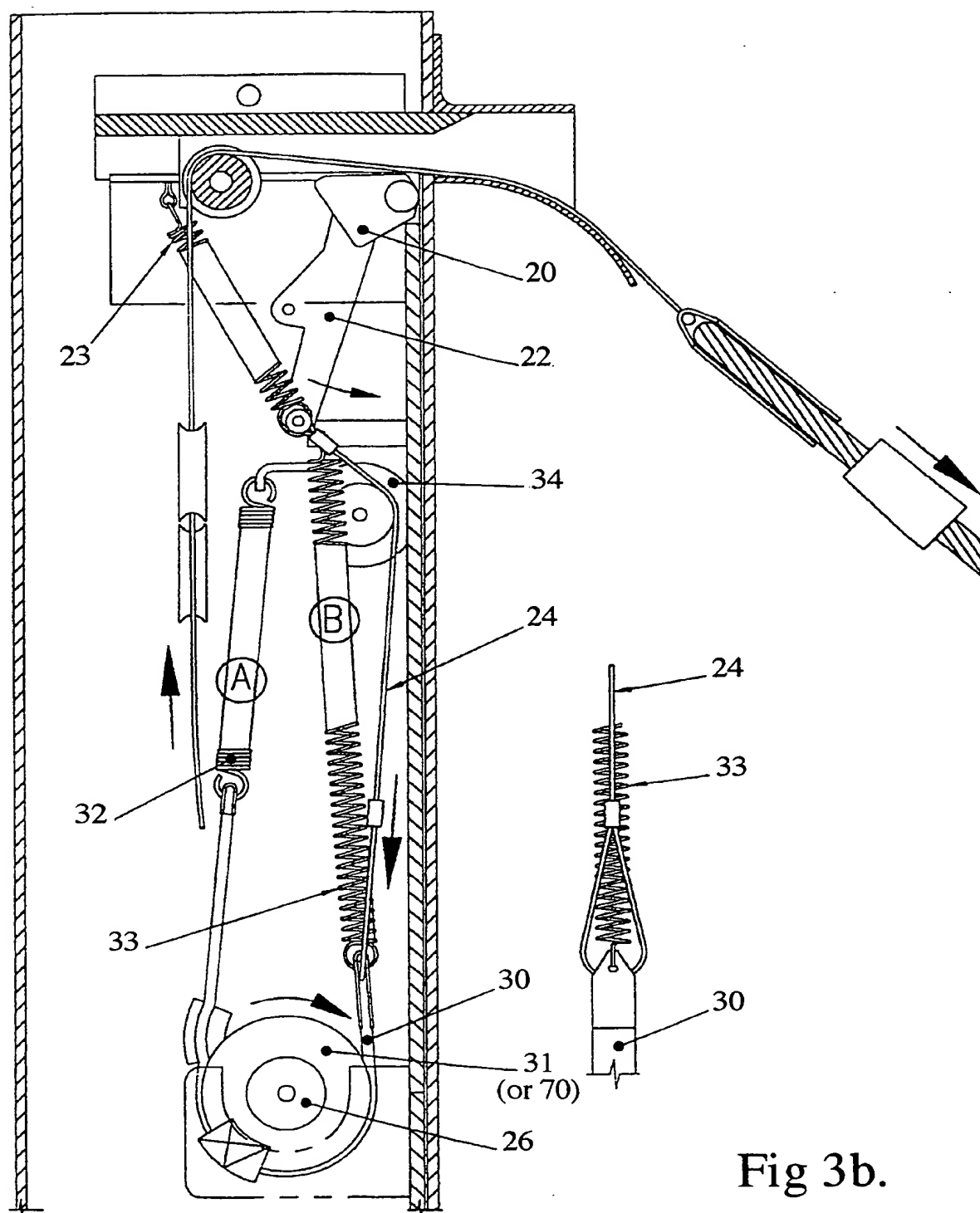


Fig 3b.

6/14

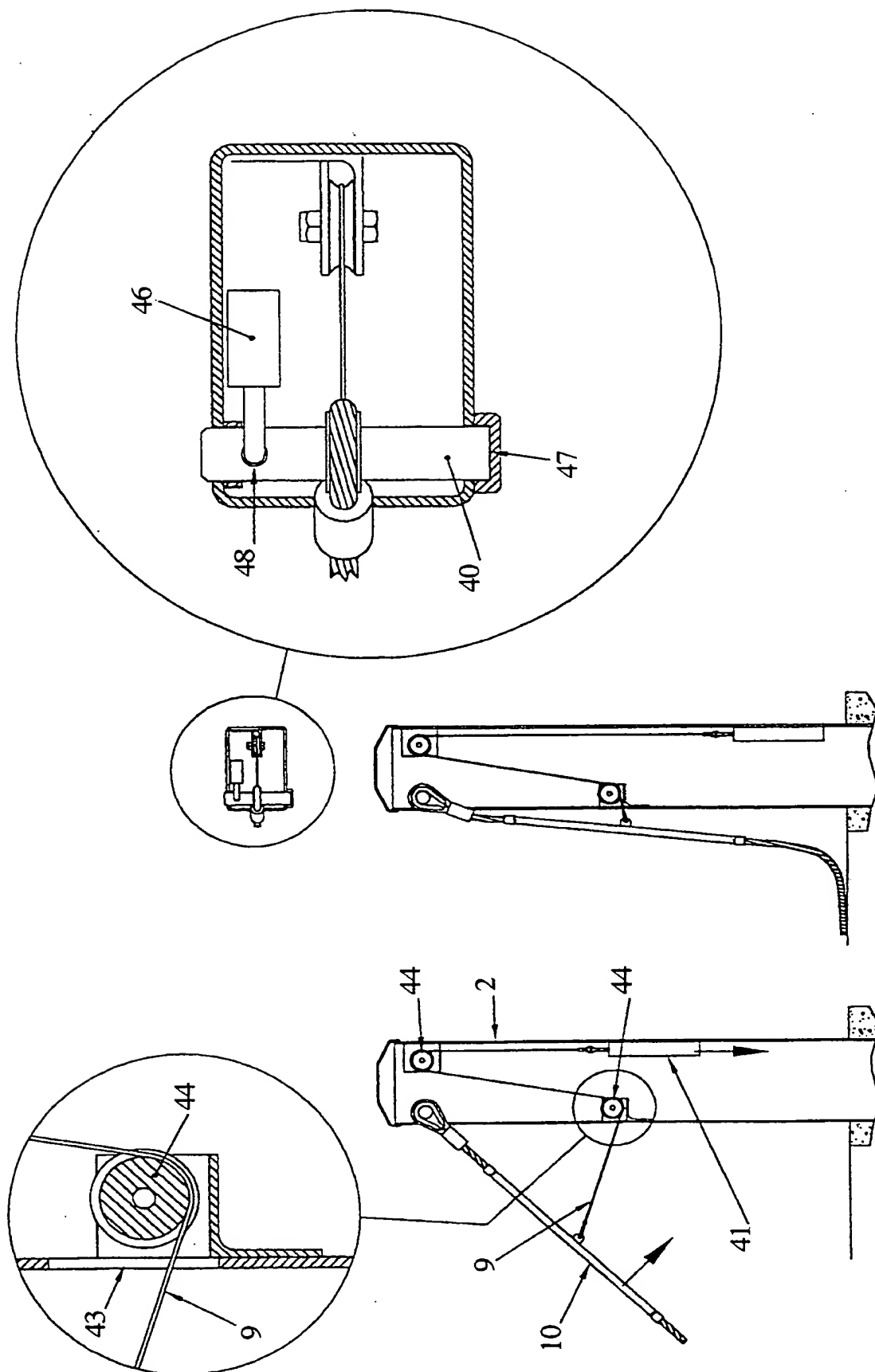


Fig 4b.

Fig 4a.

7/14

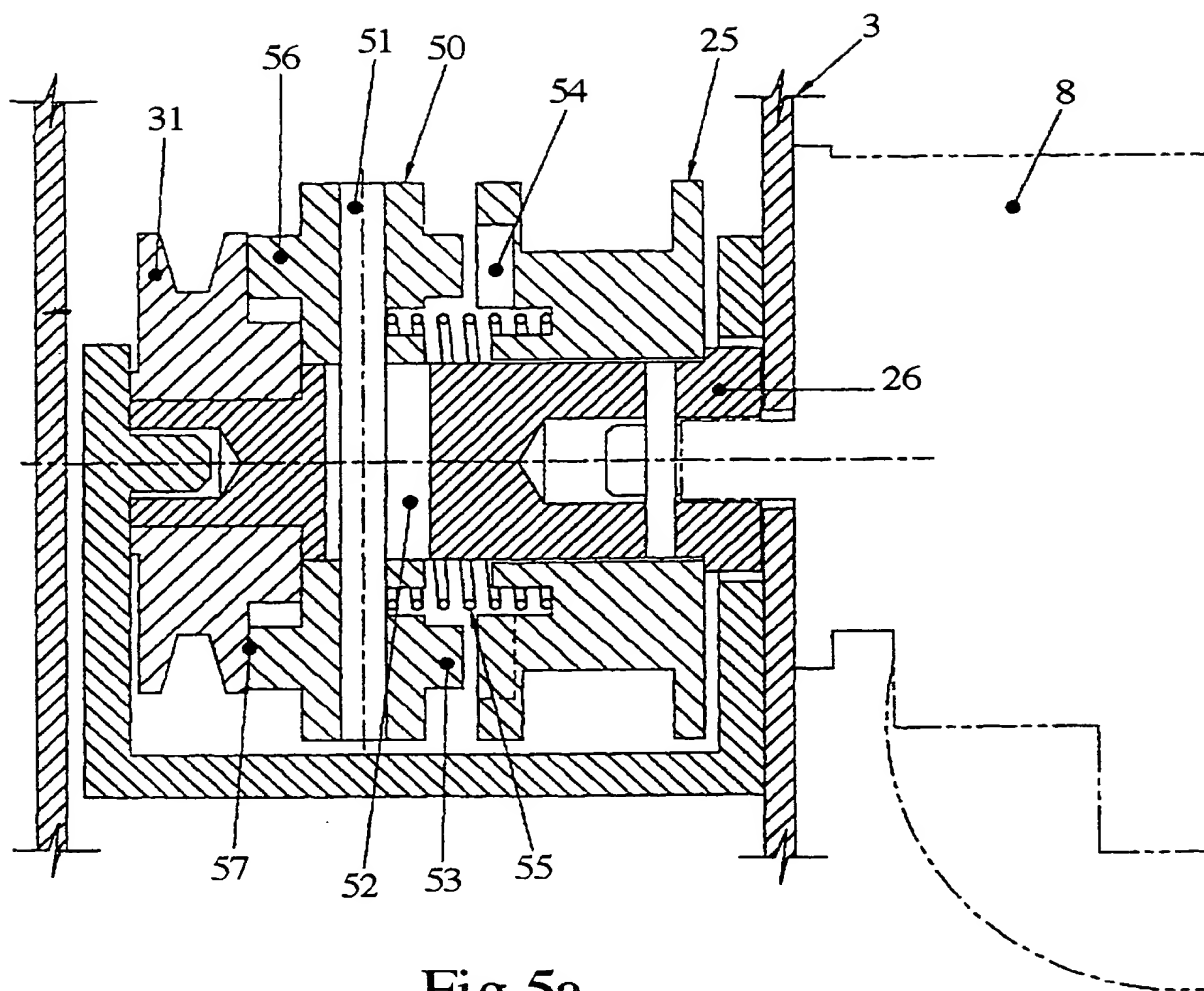


Fig 5a.

8/14

Fig 5b.

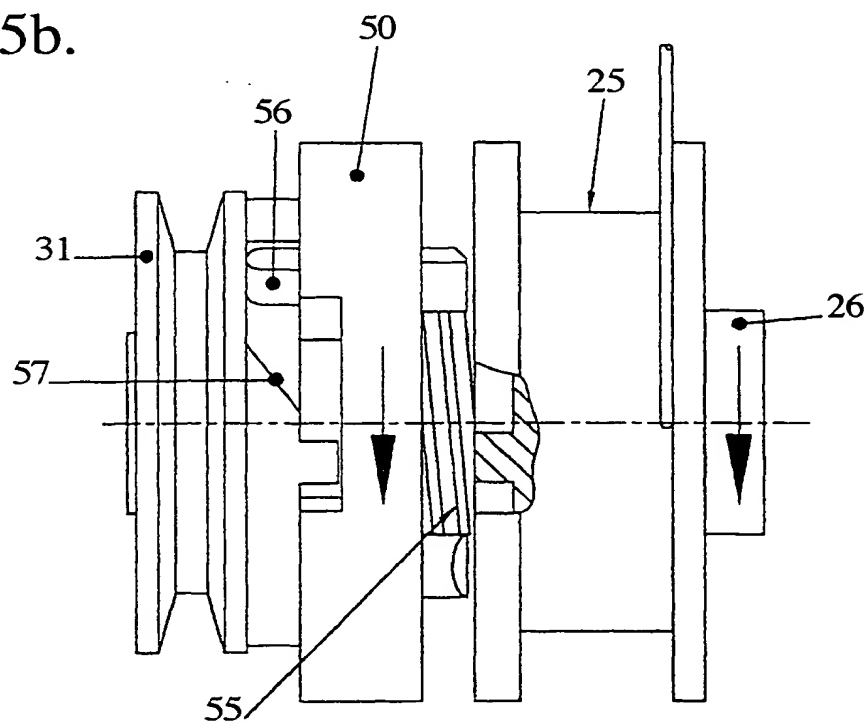
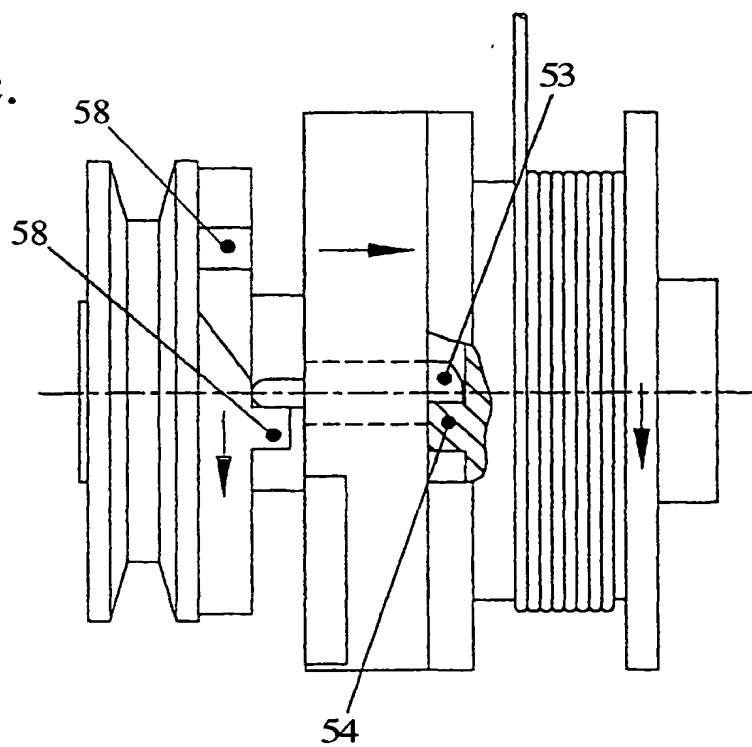


Fig 5c.



9/14

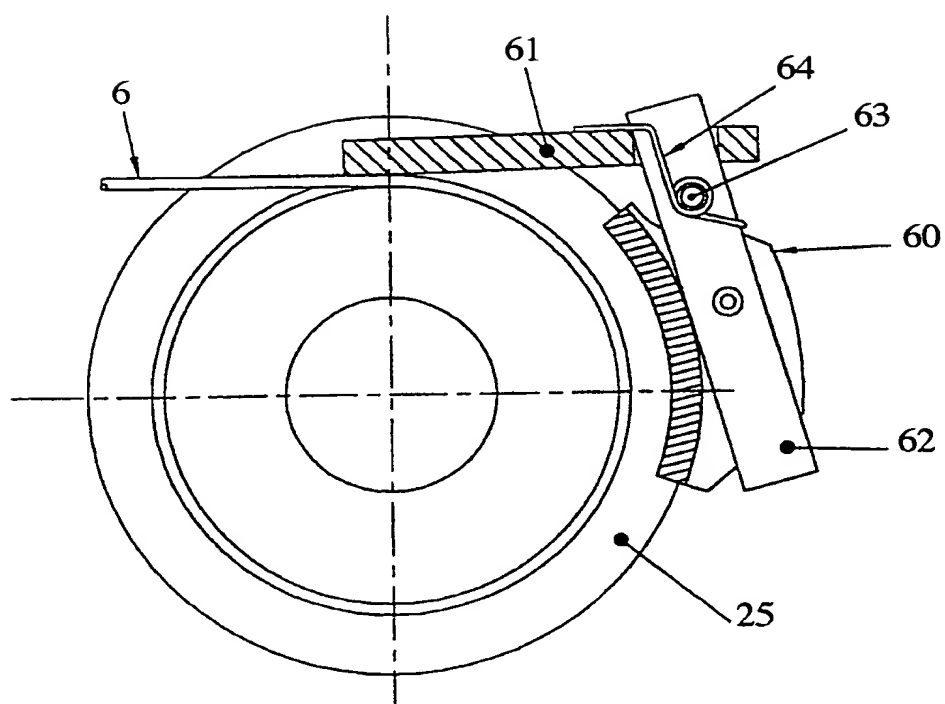
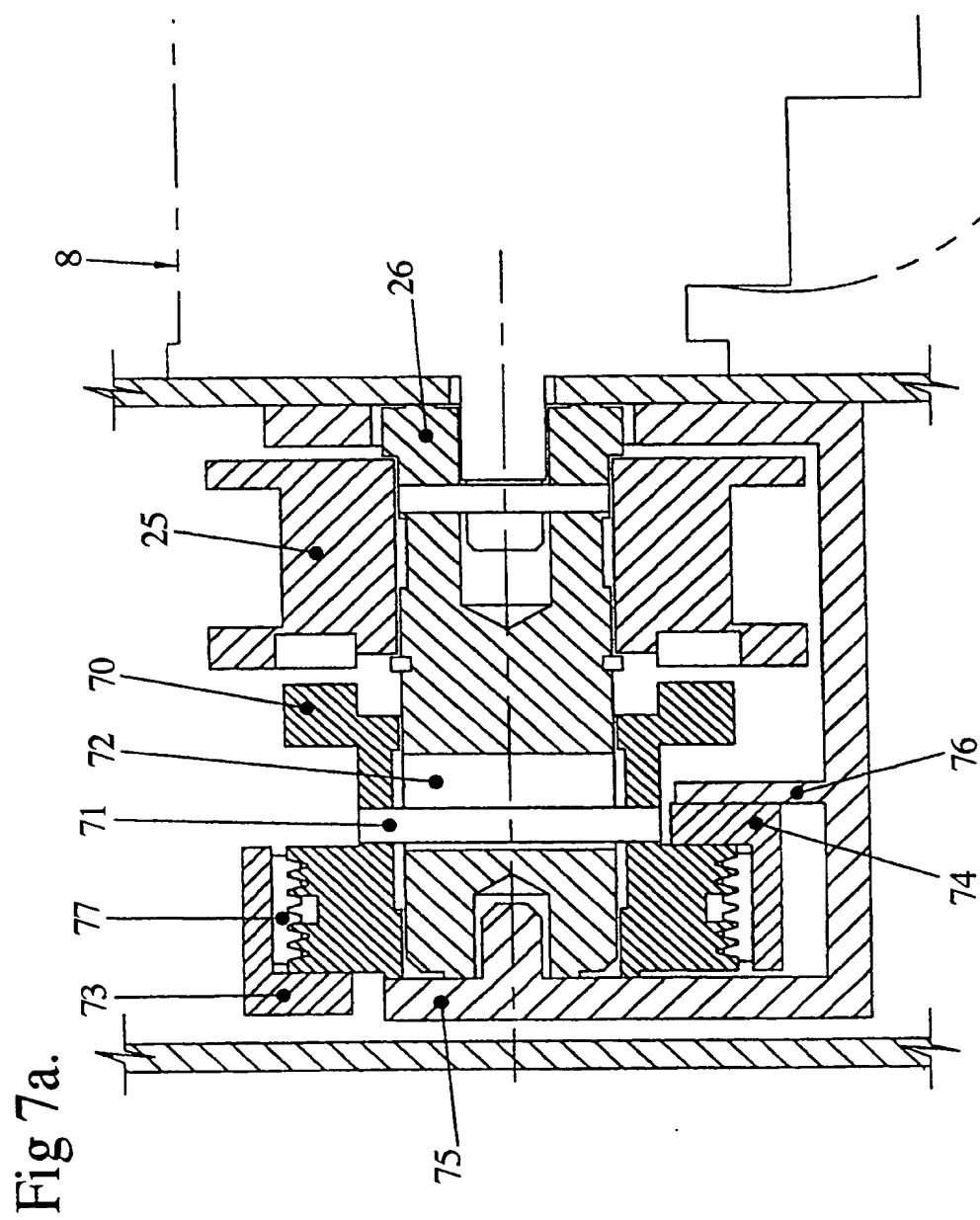


Fig 6.

10/14



11/14

Fig 7b.

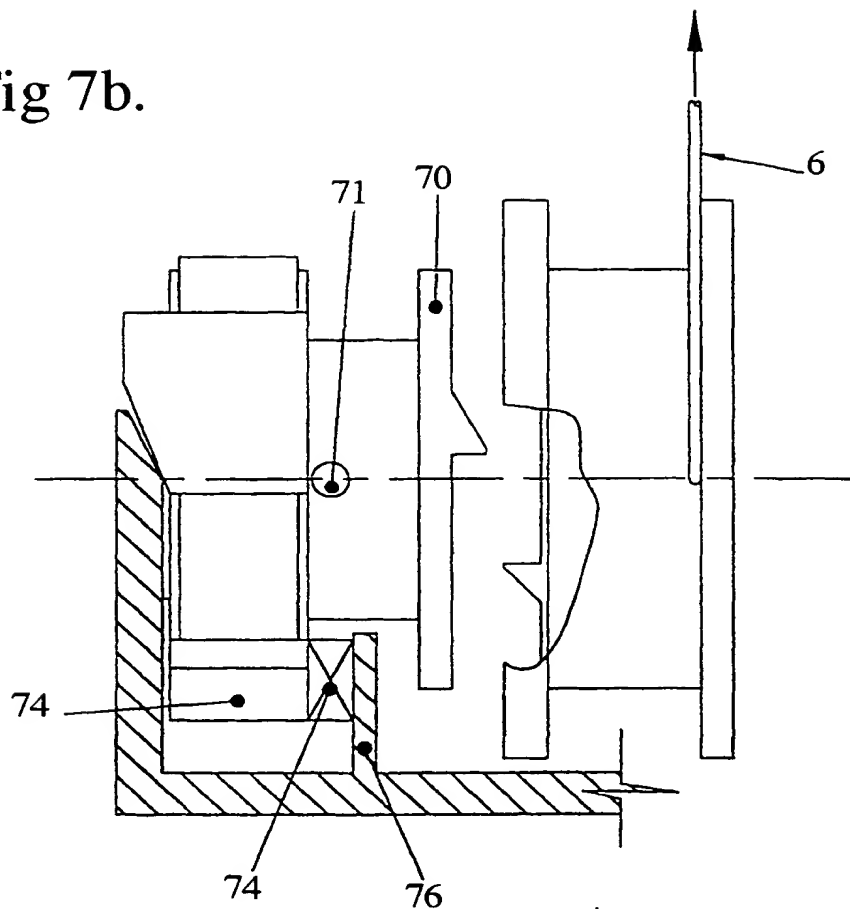
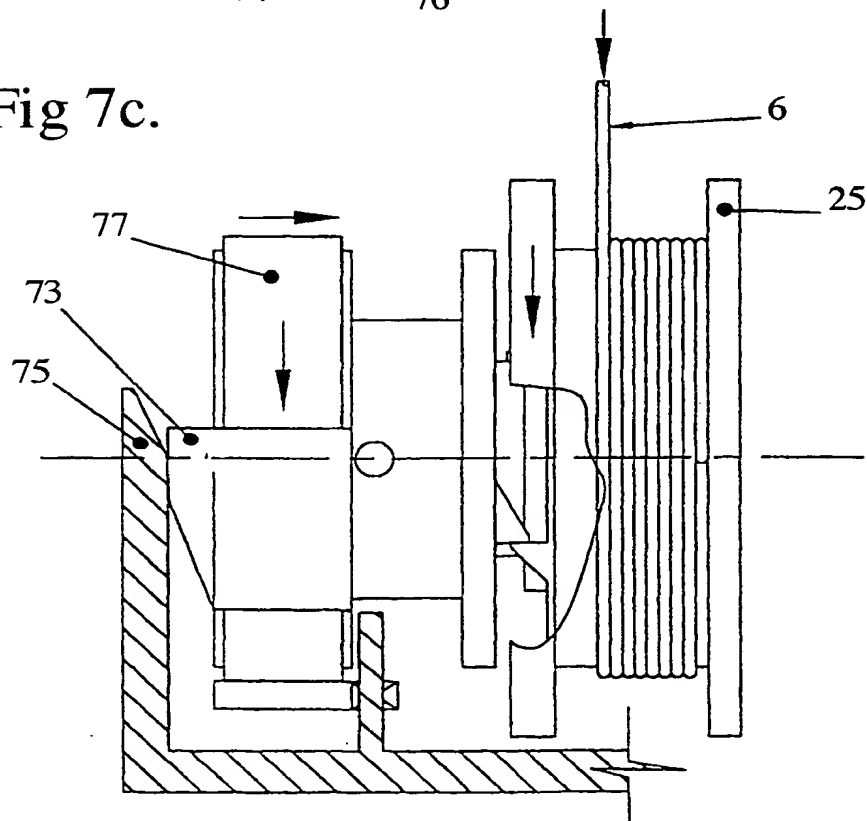


Fig 7c.



12/14

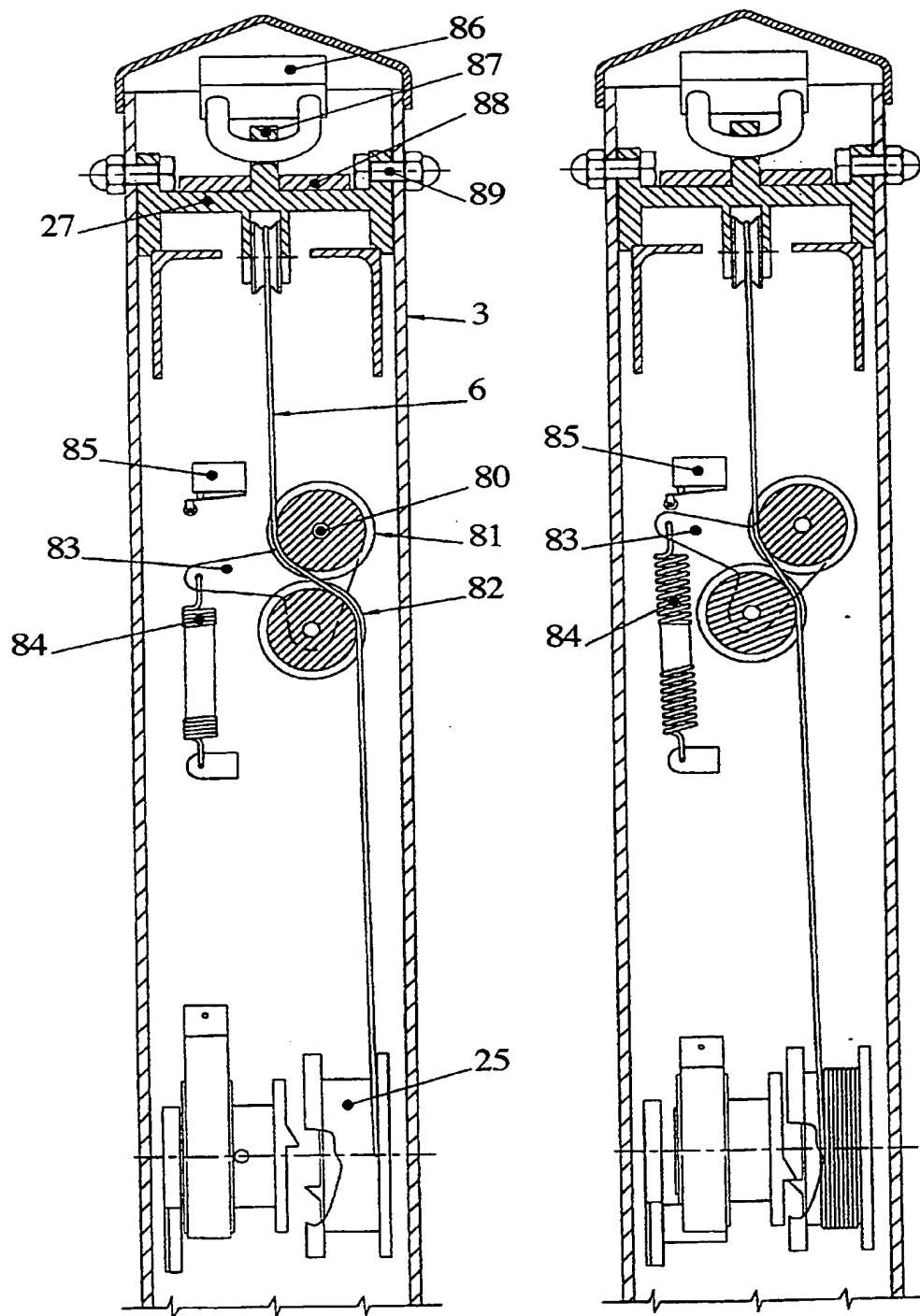
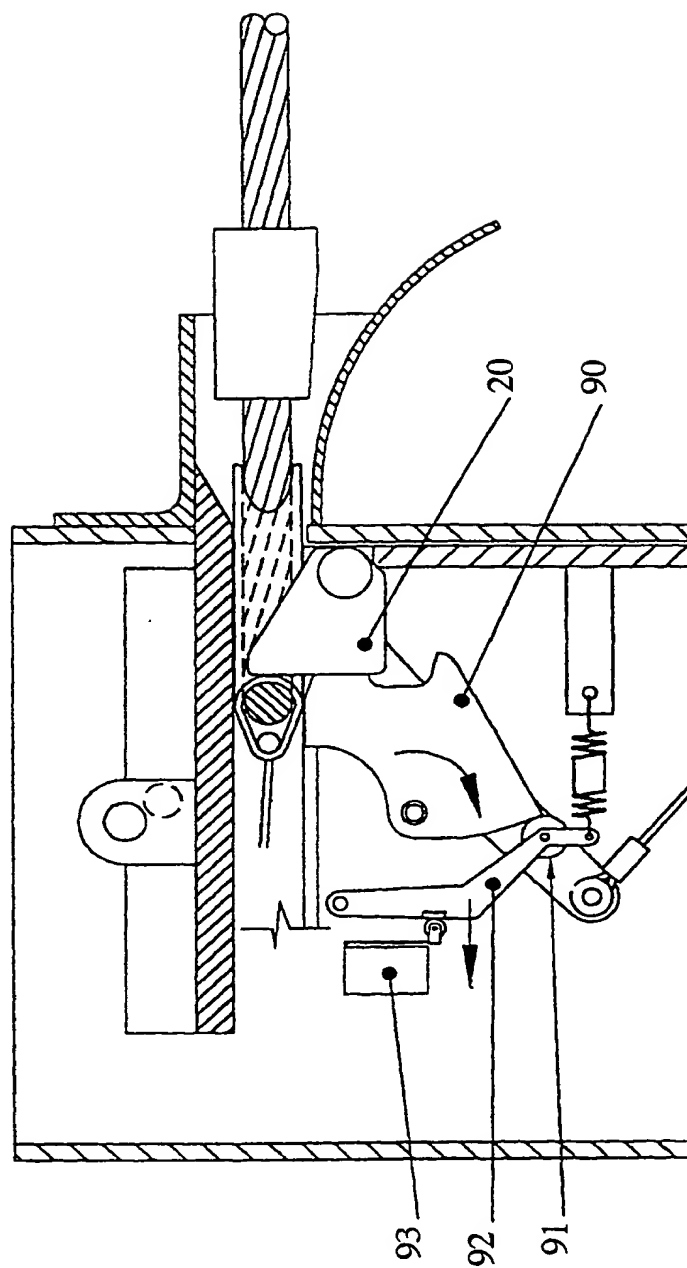


Fig 8a.

Fig 8b.

13/14

Fig 9.



14/14

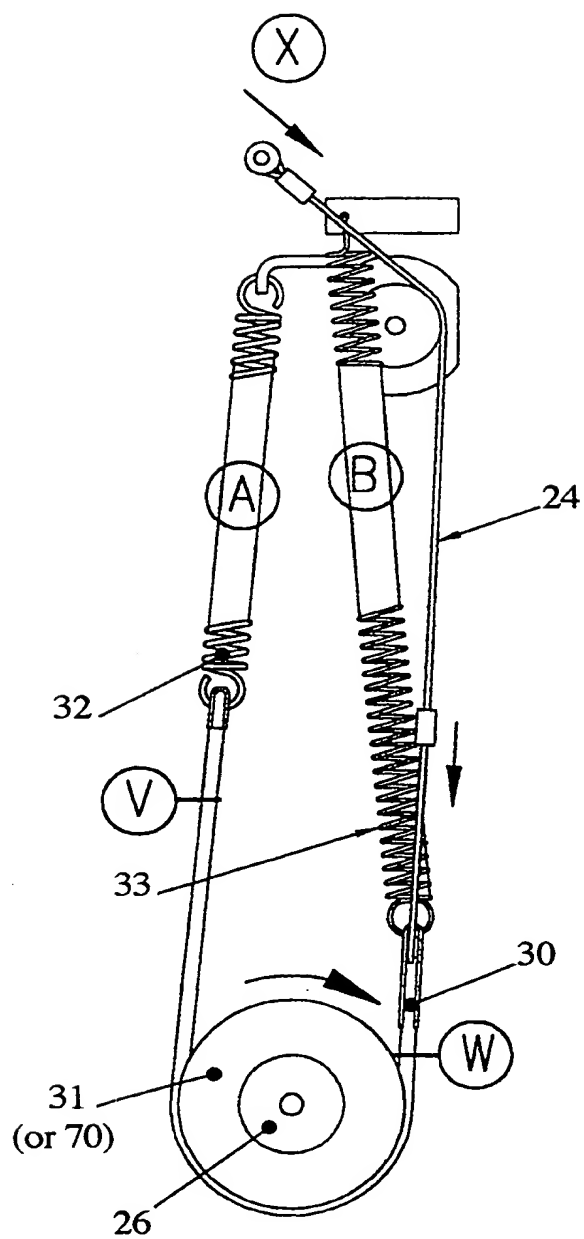


Fig 10a.

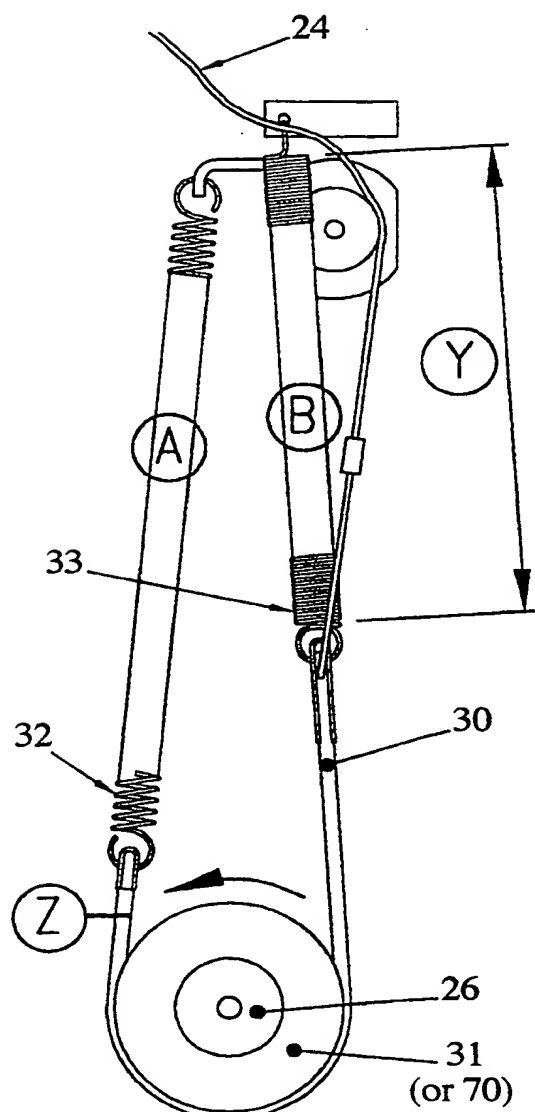


Fig 10b.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 99/00846

A. CLASSIFICATION OF SUBJECT MATTER		
Int Cl ⁶ : E01F 13/00, 13/04, B66D 1/60, E05B 53/00		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) IPC (6) : E01F 13/00, 13/04, B66D 1/60, E05B 53/00		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched AU : IPC AS ABOVE		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) Derwent wpat & US patents(USPTO)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5245787 A (SWENSON et al.) 21 September 1993 Entire document	1 - 9, 50 - 52, 55 - 57, 67
X	US 5537778 A (BARDWELL et al.) 23 July 1996 Entire document	1 - 9, 50 - 52, 55 - 57, 67
X	EP 678626 A (SNOLINE S.p.A) 25 October 1995 Entire document	1 - 9, 51, 52
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex		
<p>* Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&" document member of the same patent family</p>		
Date of the actual completion of the international search 2 December 1999		Date of mailing of the international search report - 7 DEC 1999
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200 WODEN ACT 2606 AUSTRALIA Facsimile No.: (02) 6285 3929		Authorized officer <i>D Lee for,</i> VENKAT IYER Telephone No.: (02) 6283 2144

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU 99/00846

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5752559 A (MINOW) 19 May 1998 Entire document	1 - 3, 7, 9
A	DE 3805539 A1 (KIEKERT GmbH) 31 August 1989	68
A	EP 269473 A (TRAILOR SA) 1 June 1988	68
<hr/>		

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU 99/00846

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Claims 1 and 68 are considered to define different inventions. For a detailed explanation see extra sheet.

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU 99/00846

Box II (Continued)

Lack of Unity of Invention:

The international application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept. In coming to this conclusion the International Searching Authority has found that there are different inventions as follows:

1. Claim 1 It is considered that

*a gate for controlling passage through an opening including:
a first support means located on one side of the opening
a second support means located on the other side of the opening
at least one elongate member, having a first and a second end, extendable across the opening between said first and second support means; and
a control means for releasing said at least one elongate member to thereby enable passage through said opening, and drawing in said elongate member to thereby restrict passage through said opening*

comprises a first "special technical feature".

2. Claim 68.

It is considered that

*a drive mechanism including:
a first and a second spring each fixed at one end;
a belt passing around a pulley means and connecting said first spring to said second spring;
a drive means to rotate said pulley means;
and a line attached from said belt to a device which said drive mechanism is adapted to operate*

comprises a second "special technical feature".

Since the abovementioned groups of claims do not share any of the technical features identified, a "technical relationship" between the inventions, as defined in PCT rule 13.2 does not exist. Accordingly the international application does not relate to one invention or to a single inventive concept, a priori.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/AU 99/00846

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report	Patent Family Member
US 5245787	NONE
US 5537778	CA 2161185
US 5752559	NONE
EP 678626	IT MI 940745 US 5547310
EP 269473	NONE
DE 3805539	NONE
END OF ANNEX	

PATENT COOPERATION TREATY
PCT
INTERNATIONAL PRELIMINARY EXAMINATION REPORT

REC'D 20 FEB 2001

PCT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference MCQ:PVQ:JC	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
International Application No. PCT/AU99/00846	International Filing Date (<i>day/month/year</i>) 1 October 1999	Priority Date (<i>day/month/year</i>) 1 October 1998
International Patent Classification (IPC) or national classification and IPC Int. Cl. ⁷ E01F 13/00, 13/04 B66D 1/60 E05B 53/00		
Applicant MATILDA PRODUCTS LTD et al		

1.	This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.																
2.	This REPORT consists of a total of 4 sheets, including this cover sheet. <input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT). These annexes consist of a total of 45 sheet(s).																
3.	This report contains indications relating to the following items: <table style="width: 100%;"> <tr> <td style="width: 5%;">I</td> <td><input checked="" type="checkbox"/> Basis of the report</td> </tr> <tr> <td>II</td> <td><input type="checkbox"/> Priority</td> </tr> <tr> <td>III</td> <td><input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td>IV</td> <td><input checked="" type="checkbox"/> Lack of unity of invention</td> </tr> <tr> <td>V</td> <td><input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td>VI</td> <td><input type="checkbox"/> Certain documents cited</td> </tr> <tr> <td>VII</td> <td><input type="checkbox"/> Certain defects in the international application</td> </tr> <tr> <td>VIII</td> <td><input type="checkbox"/> Certain observations on the international application</td> </tr> </table>	I	<input checked="" type="checkbox"/> Basis of the report	II	<input type="checkbox"/> Priority	III	<input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	IV	<input checked="" type="checkbox"/> Lack of unity of invention	V	<input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	VI	<input type="checkbox"/> Certain documents cited	VII	<input type="checkbox"/> Certain defects in the international application	VIII	<input type="checkbox"/> Certain observations on the international application
I	<input checked="" type="checkbox"/> Basis of the report																
II	<input type="checkbox"/> Priority																
III	<input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability																
IV	<input checked="" type="checkbox"/> Lack of unity of invention																
V	<input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement																
VI	<input type="checkbox"/> Certain documents cited																
VII	<input type="checkbox"/> Certain defects in the international application																
VIII	<input type="checkbox"/> Certain observations on the international application																

Date of submission of the demand 18 February 2000	Date of completion of the report 15 January 2001
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustalia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer VENKAT IYER Telephone No. (02) 6283 2144

I. Basis of the report**1. With regard to the elements of the international application:***

- ☐ the international application as originally filed.
- ☒ the description, pages , as originally filed,
pages , filed with the demand,
pages 1 - 26, received on 14 September 2000 with the letter of 14 September 2000
- ☒ the claims, pages , as originally filed,
pages , as amended (together with any statement) under Article 19,
pages , filed with the demand,
pages 27 - 35, 37 - 45, received on 14 September 2000 with the letter of
14 September 2000
page 36 received on 10 November with the letter of 10 November 2000
- ☒ the drawings, pages 1 - 14, as originally filed,
pages , filed with the demand,
pages , received on with the letter of
- ☐ the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , received on with the letter of

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, was on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/fig.

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

- ☐ restricted the claims.
- ☐ paid additional fees.
- ☐ paid additional fees under protest.
- ☐ neither restricted nor paid additional fees.

2. ☒ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

- ☐ complied with.
- ☒ not complied with for the following reasons:

Claim 1:

A gate for controlling passage through an opening including:

a first support means located on one side of the opening; a second support means located on the other side of the opening; at least one elongate member, having a first and a second end, extendable across the opening between said first and second support means; a first drive means to draw in said elongate member to thereby restrict passage through said opening; and a control means for coupling and decoupling said first drive means; wherein decoupling of said first drive means allows for release of said at least one elongate member to thereby enable passage through said opening and coupling of said first drive means allows for drawing in said at least one elongate member to thereby restrict passage through said opening.

Claim 73:

A drive mechanism including: a first and a second spring each fixed at one end; a belt passing around a pulley means and connecting said first spring to said second spring; a drive means to rotate said pulley means; and a line attached from said belt to a device which said drive mechanism is adapted to operate.

Since the above-mentioned groups of claims do not share any of the technical features identified, a "technical relationship" between the inventions, as defined in PCT rule 13.2 does not exist. Accordingly the international application does not relate to one invention or to a single inventive concept, a priori.

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

- ☒ all parts.
- ☐ the parts relating to claims Nos.

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims 1 - 146	YES
	Claims	NO
Inventive step (IS)	Claims 1 - 146	YES
	Claims	NO
Industrial applicability (IA)	Claims 1 - 146	YES
	Claims	NO

2. Citations and explanations (Rule 70.7)

The following documents are considered to be relevant for the purposes of this international preliminary examination report:

D1: US 5537778

D2: US 5245787

D3: EP 678626

D4: US 5752559

None of the above documents either individually or in combination disclose or suggest the invention as defined by the above claims.

The claims are therefore considered to be novel, to involve an inventive step and to be industrially applicable.